

ADOPTED: 19 May 2022

doi: 10.2903/j.efsa.2022.7392

Commodity risk assessment of *Berberis thunbergii* potted plants from Turkey

EFSA Panel on Plant Health (PLH),

Claude Bragard, Paula Baptista, Elisavet Chatzivassiliou, Francesco Di Serio, Paolo Gonthier, Josep Anton Jaques Miret, Annemarie Fejer Justesen, Alan MacLeod, Christer Sven Magnusson, Panagiotis Milonas, Juan A Navas-Cortes, Stephen Parnell, Philippe Lucien Reignault, Emilio Stefani, Hans-Hermann Thulke, Wopke Van der Werf, Antonio Vicent Civera, Jonathan Yuen, Lucia Zappalà, Jane Debode, Charles Manceau, Ciro Gardi, Olaf Mosbach Schulz, Antigoni Akrivou, Spyridon Antonatos, Despoina Beris, Christos Kritikos, Maria Kormpi, Dimitrios Papachristos, Chrysavgi Reppa and Roel Potting

Abstract

The European Commission requested the EFSA Panel on Plant Health to prepare and deliver risk assessments for commodities listed in the Commission Implementing Regulation (EU) 2018/2019 as 'High-risk plants, plant products and other objects'. This Scientific Opinion covers plant health risks posed by potted plants (2–3 years old) of *Berberis thunbergii* produced in nurseries and imported into the EU from Turkey, taking into account the available scientific information, including the technical information provided by the NPPO of Turkey. The relevance of any pest for this Opinion was based on evidence following defined criteria. Two species, the EU-quarantine pest *Bemisia tabaci* and the non-regulated pest *Malacosoma parallela*, fulfilled the relevant criteria and were selected for further evaluation. For these pests, the risk mitigation measures proposed in the technical dossier from Turkey were evaluated taking into account the possible limiting factors. For these pests, an expert judgement is given on the likelihood of pest freedom taking into consideration the risk mitigation measures acting on the pest, including uncertainties associated with the assessment. The estimated degree of pest freedom varies among the pests evaluated, with *B. tabaci* being the pest most frequently expected on the imported plants. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,928 and 10,000 plants per 10,000 would be free of *B. tabaci*. The role of *Berberis thunbergii* as possible host of *Puccinia* spp. is discussed in the body of the opinion.

© 2022 Wiley-VCH Verlag GmbH & Co. KGaA on behalf of the European Food Safety Authority.

Keywords: barberry, European Union, commodity risk assessment, plant health, plant pest

Requestor: European Commission

Question number: EFSA-Q-2020-00086, EFSA-Q-2020-00087, EFSA-Q-2020-00088, EFSA-Q-2020-00089, EFSA-Q-2020-00090

Correspondence: plants@efsa.europa.eu

Panel members: Claude Bragard, Paula Baptista, Elisavet Chatzivassiliou, Francesco Di Serio, Paolo Gonthier, Josep Anton Jaques Miret, Annemarie Fejer Justesen, Alan MacLeod, Christer Sven Magnusson, Panagiotis Milonas, Juan A Navas-Cortes, Stephen Parnell, Roel Potting, Philippe L Reignault, Emilio Stefani, Hans-Hermann Thulke, Wopke Van der Werf, Antonio Vicent Civera, Jonathan Yuen and Lucia Zappalà.

Declarations of interest: The declarations of interest of all scientific experts active in EFSA's work are available at <https://ess.efsa.europa.eu/doi/doiweb/doisearch>.

Acknowledgments: EFSA wishes to acknowledge the important contribution of the trainee Patricia Nascimento.

Suggested citation: EFSA PLH Panel (EFSA Panel on Plant Health), Bragard C, Baptista P, Chatzivassiliou E, Di Serio F, Gonthier P, Jaques Miret JA, Justesen AF, MacLeod A, Magnusson CS, Milonas P, Navas-Cortes JA, Parnell S, Reignault PL, Stefani E, Thulke H-H, Van der Werf W, Civera AV, Yuen J, Zappalà L, Debode J, Manceau C, Gardi C, Schulz OM, Akrivou A, Antonatos S, Beris D, Kritikos C, Kormpi M, Papachristos D, Reppa C and Potting R, 2022. Scientific Opinion on the commodity risk assessment of *Berberis thunbergii* potted plants from Turkey. EFSA Journal 2022;20(6):7392, 43 pp. <https://doi.org/10.2903/j.efsa.2022.7392>

ISSN: 1831-4732

© 2022 Wiley-VCH Verlag GmbH & Co. KGaA on behalf of the European Food Safety Authority.

This is an open access article under the terms of the [Creative Commons Attribution-NoDerivs](#) License, which permits use and distribution in any medium, provided the original work is properly cited and no modifications or adaptations are made.

Reproduction of the images listed below is prohibited and permission must be sought directly from the copyright holder:

Figure 2: Provided by the NPPO of Turkey.



The EFSA Journal is a publication of the European Food Safety Authority, a European agency funded by the European Union.



Table of Contents

Abstract.....	1
1. Introduction.....	4
1.1. Background and terms of reference as provided by European Commission	4
1.1.1. Background	4
1.1.2. Terms of reference	4
1.2. Interpretation of the terms of reference.....	4
2. Data and methodologies.....	6
2.1. Data provided by the NPPO of Turkey.....	6
2.2. Literature searches performed by EFSA.....	7
2.3. Methodology.....	8
2.3.1. Commodity data.....	8
2.3.2. Identification of pests potentially associated with the commodity	8
2.3.3. Listing and evaluation of risk mitigation measures.....	9
2.3.4. Expert knowledge elicitation.....	9
3. Commodity data.....	10
3.1. Description of the commodity.....	10
3.2. Description of the production areas	10
3.3. Production and handling processes	10
3.3.1. Growing conditions.....	10
3.3.2. Source of planting material	10
3.3.3. Production cycle.....	11
3.3.4. Pest monitoring during production	11
3.3.5. Post-harvest processes and export procedure.....	11
4. Identification of pests potentially associated with the commodity	11
4.1. Selection of relevant EU-quarantine pests associated with the commodity	11
4.2. Selection of other relevant pests (non-regulated in the EU) associated with the commodity	12
4.3. Overview of interceptions.....	13
4.4. List of potential pests not further assessed.....	13
4.5. Summary of pests selected for further evaluation	13
5. Risk mitigation measures	13
5.1. Possibility of pest presence in the export nurseries	14
5.2. Risk mitigation measures applied in Turkey	14
5.3. Evaluation of the current measures for the selected relevant pests including uncertainties.....	15
5.3.1. Overview of the evaluation of <i>Bemisia tabaci</i>	15
5.3.2. Overview of the evaluation of <i>Malacosoma parallela</i>	16
5.3.3. Outcome of Expert Knowledge Elicitation	16
6. Conclusions.....	19
References.....	19
Glossary	20
Abbreviations	21
Appendix A – Data sheets of pests selected for further evaluation via expert knowledge elicitation.....	22
Appendix B – Web of Science All Databases Search String.....	38
Appendix C – List of pests that can potentially cause an effect not further assessed.....	42
Appendix D – Excel file with the pest list of <i>Berberis</i> spp.....	43

1. Introduction

1.1. Background and terms of reference as provided by European Commission

1.1.1. Background

The Plant Health Regulation (EU) 2016/2031¹, on the protective measures against pests of plants, has been applied from December 2019. Provisions within the above Regulation are in place for the listing of 'high risk plants, plant products and other objects' (Article 42) on the basis of a preliminary assessment, and to be followed by a commodity risk assessment. A list of 'high risk plants, plant products and other objects' has been published in Regulation (EU) 2018/2019². Scientific opinions are therefore needed to support the European Commission and the Member States in the work connected to Article 42 of Regulation (EU) 2016/2031, as stipulated in the terms of reference.

1.1.2. Terms of reference

In view of the above and in accordance with Article 29 of Regulation (EC) No 178/2002³, the Commission asks EFSA to provide scientific opinions in the field of plant health.

In particular, EFSA is expected to prepare and deliver risk assessments for commodities listed in the relevant Implementing Act as "High risk plants, plant products and other objects". Article 42, paragraphs 4 and 5, establishes that a risk assessment is needed as a follow-up to evaluate whether the commodities will remain prohibited, removed from the list and additional measures will be applied or removed from the list without any additional measures. This task is expected to be on-going, with a regular flow of dossiers being sent by the applicant required for the risk assessment.

Therefore, to facilitate the correct handling of the dossiers and the acquisition of the required data for the commodity risk assessment, a format for the submission of the required data for each dossier is needed.

Furthermore, a standard methodology for the performance of "commodity risk assessment" based on the work already done by Member States and other international organisations needs to be set.

In view of the above and in accordance with Article 29 of Regulation (EC) No 178/2002, the Commission asks EFSA to provide scientific opinion in the field of plant health for *Berberis thunbergii* exported from Turkey in the EU taking into account the available scientific information, including the technical dossier provided by Turkey.

1.2. Interpretation of the terms of reference

The EFSA Panel on Plant Health (hereafter referred to as 'the Panel') was requested to conduct a commodity risk assessment of *Berberis thunbergii* from Turkey following the Guidance on commodity risk assessment for the evaluation of high-risk plant dossiers (EFSA PLH Panel, 2019a).

The EU quarantine pests that are regulated as a group in the Commission Implementing Regulation (EU) 2019/2072 were considered and evaluated separately at species level.

Annex II of Implementing Regulation (EU) 2019/2072 lists certain pests as non-European populations or isolates or species. These pests are regulated quarantine pests. Consequently, the respective European populations, or isolates, or species are non-regulated pests.

Annex VII of the same Regulation, in certain cases (e.g. point 32), makes reference to the following countries that are excluded from the obligation to comply with specific import requirements for those non-European populations, or isolates, or species: Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Faeroe Islands, Georgia, Iceland, Liechtenstein,

¹ Regulation (EU) 2016/2031 of the European Parliament and of the Council of 26 October 2016 on protective measures against pests of plants, amending Regulations (EU) 228/2013, (EU) 652/2014 and (EU) 1143/2014 of the European Parliament and of the Council and repealing Council Directives 69/464/EEC, 74/647/EEC, 93/85/EEC, 98/57/EC, 2000/29/EC, 2006/91/EC and 2007/33/EC. OJ L 317, 23.11.2016, pp. 4–104.

² Commission Implementing Regulation (EU) 2018/2019 of 18 December 2018 establishing a provisional list of high risk plants, plant products or other objects, within the meaning of Article 42 of Regulation (EU) 2016/2031 and a list of plants for which phytosanitary certificates are not required for introduction into the Union, within the meaning of Article 73 of that Regulation C/2018/8877. OJ L 323, 19.12.2018, pp. 10–15.

³ Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. OJ L 31, 1.2.2002, pp. 1–24.

Moldova, Monaco, Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (SeveroZapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug), San Marino, Serbia, Switzerland, Turkey, Ukraine and United Kingdom (except Northern Ireland⁴). Those countries are historically linked to the reference to 'non-European countries' existing in the previous legal framework, Directive 2000/29/EC.

Consequently, for those countries,

- i) any pests identified, which are listed as non-European species in Annex II of Implementing Regulation (EU) 2019/2072 should be investigated as any other non-regulated pest.
- ii) any pest found in a European country that belongs to the same denomination as the pests listed as non-European populations or isolates in Annex II of Implementing Regulation (EU) 2019/2072, should be considered as European populations or isolates and should not be considered in the assessment of those countries.

Pests listed as 'Regulated Non-Quarantine Pest (RNQP)' in Annex IV of the Commission Implementing Regulation (EU) 2019/2072, and deregulated pests (i.e. pests which were listed as quarantine pests in the Council Directive 2000/29/EC and were deregulated by Commission Implementing Regulation (EU) 2019/2072) were not considered for further evaluation.

In its evaluation, the Panel:

- Checked whether the information provided by the applicant (Republic of Turkey, Ministry of Agriculture and Forestry, National Plant Protection Organization – NPPO of Turkey) in the technical dossier (hereafter referred to as 'the Dossier') was sufficient to conduct a commodity risk assessment. When necessary, additional information was requested to the applicant.
- Selected the relevant union EU-regulated quarantine pests and protected zone quarantine pests (as specified in Commission Implementing Regulation (EU) 2019/2072⁵, hereafter referred to as 'EU quarantine pests') and other relevant pests present in Turkey and associated with the commodity.
- Assessed whether the applicant country implements specific measures for Union quarantine pests for which specific measures are in place for the import of the commodity from the specific country in the relevant legislative texts for emergency measures (https://ec.europa.eu/food/plant/plant_health_biosecurity/legislation/emergency_measures_en); the assessment was restricted to whether the applicant country applies those measures. The effectiveness of those measures was not assessed.
- Assessed whether or not the applicant country implements the special requirements specified in Annex VII (points 1–101) of the Commission Implementing Regulation (EU) 2019/2072 targeting Union quarantine pests for the commodity in question from the specific country.
- Assessed the effectiveness of the measures described in the dossier for those Union quarantine pests for which no specific measures are in place for the import of the commodity from the specific applicant country and other relevant pests present in the applicant country and associated with the commodity.

Risk management decisions are not within EFSA's remit. Therefore, the Panel provided a rating based on expert judgement regarding the likelihood of pest freedom for each relevant pest given the risk mitigation measures implemented by the NPPO of Turkey.

⁴ In accordance with the Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Atomic Energy Community, and in particular Article 5(4) of the Protocol on Ireland/Northern Ireland in conjunction with Annex 2 to that Protocol, for the purposes of this Annex, references to Member States include the United Kingdom in respect of Northern Ireland.

⁵ Commission Implementing Regulation (EU) 2019/2072 of 28 November 2019 establishing uniform conditions for the implementation of Regulation (EU) 2016/2031 of the European Parliament and the Council, as regards protective measures against pests of plants, and repealing Commission Regulation (EC) No 690/2008 and amending Commission Implementing Regulation (EU) 2018/2019, OJ L 319, 10.12.2019, p. 1–279.

2. Data and methodologies

2.1. Data provided by the NPPO of Turkey

The Panel considered all the data and information (hereafter called 'the Dossier') provided by the NPPO of Turkey and received by EFSA on 9 January 2020 and 15 June 2020, including the additional information provided by the NPPO of Turkey on 17 December 2021, after EFSA's request. The Dossier is managed by EFSA.

The structure and overview of the Dossier is shown in Table 1. The number of the relevant section is indicated in the opinion when referring to a specific part of the Dossier.

Table 1: Structure and overview of the Dossier

Dossier section	Overview of contents	Filename
1.0	Technical dossier on <i>Berberis</i>	BARBERRY_Technical_Report-TR-27.11.2019.pdf
2.0	Technical dossier on <i>Berberis</i> (second submission)	Barberry_Tecnical_Report-TR-05.05.2020_V2 Commented.pdf
3.0	Additional information provided by NPPO of Turkey	Question_and_answer_on_Berberis_spp.pdf

The data and supporting information provided by the NPPO of Turkey formed the basis of the commodity risk assessment.

Table 2 shows the main data sources used by the NPPO of Turkey to compile the Dossier (details on literature searches can be found in the Dossier Section 2.1).

Table 2: Database sources used in the literature searches by the NPPO of Turkey

Acronym/short title	Database name and service provider	URL of database	Justification for choosing database
PPTI	Name: Plant Protection Technical Instructions Provider: NPPO of Turkey	https://www.tarimorman.gov.tr/TAGEM/Belgeler/Bitki%20Zarar%C4%B1lar%C4%B1%20Ziraai%20M%C3%BCcadele%20Teknik%20Talimatlar%C4%B1.pdf https://www.tarimorman.gov.tr/TAGEM/Belgeler/Bitki%20Hastal%C4%B1klar%C4%B1%20ve%20Yabanc%C4%B1%20Ot%20Zirai%20M%C3%BCcadele%20Teknik%20Talimatlar%C4%B1.pdf	These instructions are prepared regarding pests in Turkey, which cause damages on their hosts economically. They cover total of 644 pests including bacteria, phytoplasmas, fungi, insects, viruses and viroids.
CABI ISC	CABI Invasive Species Compendium Provider: CAB International	https://www.cabi.org/ISC	EFSA recommendation
EPPO GD	EPPO Global Database Provider: European and Mediterranean Plant Protection Organization	https://gd.eppo.int/	EFSA recommendation
Plant Protection Bulletin	Plant Protection Bulletin published by the Plant Protection Central Research Institute	https://dergipark.org.tr/en/pub/bitkorb	The journal is published four times a year with original research articles in English or Turkish languages on plant protection and health.

Acronym/ short title	Database name and service provider	URL of database	Justification for choosing database
Fauna Europaea	Name: Fauna Europaea Provider: Museum für Naturkunde Leibniz-Institut für Evolutions- und Biodiversitätsforschung	https://fauna-eu.org/	Fauna Europaea is Europe's main zoological taxonomic index. The database lists scientific names and distributions of all living, currently known, multicellular, European land and fresh water animal species

2.2. Literature searches performed by EFSA

Literature searches were undertaken by EFSA to complete a list of pests potentially associated with *Berberis* spp. Two searches were combined: (i) a general search to identify pests of *Berberis* spp., in different databases; and (ii) a tailored search to identify whether these pests are present or not in Turkey. The searches were launched on 23 August 2021. No language, date or document type restrictions were applied in the search strategy.

The Panel used the databases indicated in Table 3 to compile the list of pests associated with *Berberis* spp. As for Web of Science, the literature search was performed using a specific, ad hoc established search string (see Appendix B). The search strategy used for Web of Science Databases was designed combining common names for pests and diseases, terms describing symptoms of plant diseases and the scientific and English common names of the commodity. The following species, indicated in the dossier, were included in the search: *Berberis thunbergii*, *Berberis* spp.

All pests already retrieved using the other databases were removed from the search terms in order to be able to reduce the number of records to be screened. The string was run in 'All Databases' with no range limits for time or language filters.

Table 3: Databases used by EFSA for the compilation of the pest list associated with the species of genus *Berberis* spp. relevant for this Dossier

Database	Platform/Link
Aphids on World Plants	https://www.aphidsonworldsplants.info/C_HOSTS_AAIntro.htm
CABI Crop Protection Compendium	https://www.cabi.org/cpc/
Database of Insects and their Food Plants	https://www.brc.ac.uk/dbif/hosts.aspx
Database of the World's Lepidopteran Hostplants	https://www.nhm.ac.uk/our-science/data/hostplants/search/index.dsml
EPPO Global Database	https://gd.eppo.int/
EUROPHYT	https://webgate.ec.europa.eu/europhyt/
Leaf-miners	https://www.leafmines.co.uk/html/plants.htm
Nemaplex	https://nemaplex.ucdavis.edu/Nemabase2010/PlantNematodeHostStatusDDQuery.aspx
Plant Viruses Online	https://bio-mirror.im.ac.cn/mirrors/pvo/vide/famindex.htm
International Committee on Taxonomy of Viruses (ICTV) - Master Species List	https://talk.ictvonline.org/files/master-species-lists/m/msl/12314
Scalenet	https://scalenet.info/associates/
Spider Mites Web	https://www1.montpellier.inra.fr/CBGP/spmweb/advanced.php
USDA ARS Fungi Database	https://nt.ars-grin.gov/fungalatabases/fungushost/fungushost.cfm
Index Fungorum	https://www.indexfungorum.org/Names/Names.asp
Mycobank	https://www.mycobank.com
Web of Science: All Databases (Web of Science Core Collection, CABI: CAB Abstracts, BIOSIS Citation Index, Chinese	https://www.webofknowledge.com

Database	Platform/Link
Science Citation Database, Current Contents Connect, Data Citation Index	
FSTA, KCI-Korean Journal Database, Russian Science Citation Index, MEDLINE	
SciELO Citation Index, Zoological Record)	
World Agroforestry	https://www.worldagroforestry.org/treedb2/speciesprofile.php?Spid=1749
Catalogue of the Cecidomyiidae (Diptera) of the world	https://www.ars.usda.gov/ARUserFiles/80420580/Gagne_2014_World_Cecidomyiidae_Catalog_3rd_Edition.pdf
Catalogue of the Eriophyoidea (Acarina: Prostigmata) of the world	https://www.cabi.org/isc/abstract/19951100613
Global Biodiversity Information Facility (GBIF)	https://www.gbif.org/

Additional searches, limited to retrieve documents, were run when developing the opinion. The available scientific information including previous EFSA opinions on the relevant pests and diseases (see pest data sheets in Appendix A) and the relevant literature and legislation (e.g. Regulation (EU) 2016/2031; Commission Implementing Regulations (EU) 2018/2019; (EU) 2018/2018 and (EU) 2019/2072) were taken into account.

2.3. Methodology

When developing the opinion, the Panel followed the EFSA Guidance on commodity risk assessment for the evaluation of high-risk plant dossiers (EFSA PLH Panel, 2019a).

In the first step, pests potentially associated with the commodity in the country of origin (EU-quarantine pests and other pests) that may require risk mitigation measures are identified. The EU non-quarantine pests not known to occur in the EU were selected based on evidence of their potential impact in the EU. After the first step, all the relevant pests that may need risk mitigation measures were identified.

In the second step, the implemented risk mitigation measures for each relevant pest were evaluated in terms of efficacy or compliance with EU requirements as explained in Section 1.2.

A conclusion on the likelihood of the commodity being free from each of the relevant pests was determined and uncertainties were identified using expert judgements.

Pest freedom was assessed by estimating the number of infested/infected potted plants out of 10,000 exported potted plants.

2.3.1. Commodity data

Based on the information provided by the NPPO of Turkey, the characteristics of the commodity were summarised.

2.3.2. Identification of pests potentially associated with the commodity

To evaluate the pest risk associated with the importation of *Berberis thunbergii* imported from Turkey, a pest list was compiled. The pest list is a compilation of all identified plant pests associated with *Berberis* spp. based on information provided in the Dossier Section 4 and on searches performed by the Panel.

The scientific names of the host plants (i.e. *Berberis* spp., *Berberis thunbergii*, etc.) were used when searching in the EPPO Global database (EPPO online) and CABI Crop Protection Compendium.

EUROPHYT was consulted by searching for the interceptions associated with commodities imported from Turkey, at species and genus level, from 1994 to May 2020 and TRACES for interceptions from May 2020 to present (April 2022). For the pests selected for further evaluation, a search in the EUROPHYT and/or TRACES was performed for the interceptions from the whole world, at species and genus level.

The titles and abstracts of the scientific papers retrieved were screened and the pests associated with *Berberis* spp. were included in the pest list. The pest list was eventually further compiled with other relevant information (e.g. EPPO code per pest, taxonomic information, categorisation, distribution) useful for the selection of the pests relevant for the purposes of this opinion.

The compiled pest list (see Microsoft Excel® file in Appendix D) includes all identified pests that use *Berberis* spp. as a host.

The evaluation of the compiled pest list was done in two steps: first, the relevance of the EU-quarantine pests was evaluated (Section 4.1); second, the relevance of any other plant pest was evaluated (Section 4.2).

2.3.3. Listing and evaluation of risk mitigation measures

The proposed risk mitigation measures were listed and evaluated. When evaluating the likelihood of pest freedom at origin, the following types of potential infection/infestation sources for *Berberis thunbergii* in nurseries and relevant risk mitigation measures were considered (see also Figure 1):

- pest entry from surrounding areas,
- pest entry with new plants/seeds,
- pest spread within the nursery.

The effect of risk mitigation measures adopted in the plant nurseries (as communicated by the NPPO of Turkey) was evaluated with Expert Knowledge Elicitation (EKE) according to the Guidance on uncertainty analysis in scientific assessment (EFSA Scientific Committee, 2018).

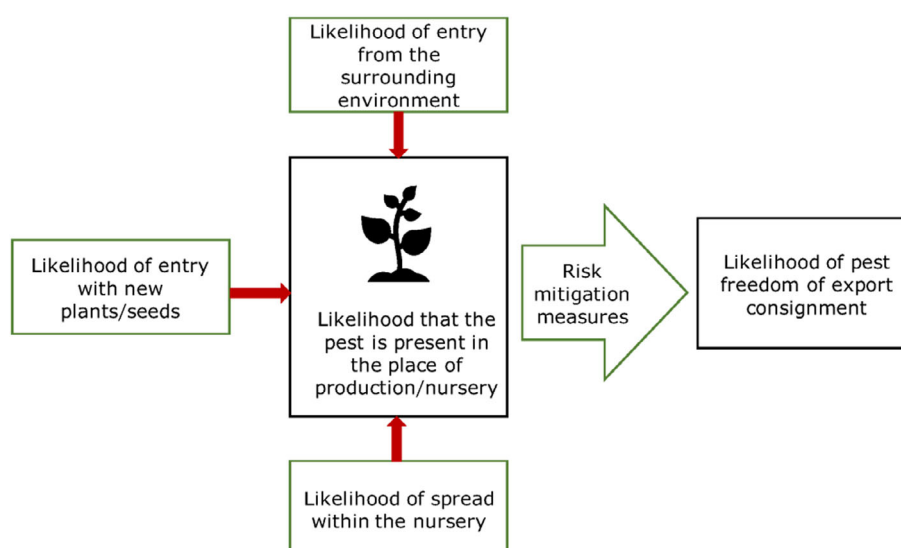


Figure 1: Conceptual framework to assess likelihood that plants are exported free from relevant pests. Source EFSA PLH Panel (2019b)

Information on the biology, estimates of likelihood of entry of the pest to the nursery and spread within the nursery and the effect of the measures on a specific pest is summarised in pest data sheets compiled for each pest selected for further evaluation (see Appendix A).

2.3.4. Expert knowledge elicitation

To estimate the pest freedom of the commodities, an Expert Knowledge Elicitation (EKE) was performed following EFSA guidance (Annex B.8 of EFSA Scientific Committee, 2018). The specific question for EKE was defined as follows: 'Taking into account (i) the risk mitigation measures listed in the Dossier, and (ii) other relevant information, how many of 10,000 *Berberis thunbergii* potted plants will be infested with the relevant pest/pathogen when arriving in the EU?'

The risk assessment uses individual potted plants as the most suitable unit. The following reasoning is given:

- There is no quantitative information available regarding clustering of plants during production.
- For the pests under consideration, a cross-contamination during transport is not likely.
- Potted plants will be finally distributed to final consumers by wholesaler and retailers.

The uncertainties associated with the EKE were taken into account and quantified in the probability distribution applying the semi-formal method described in Section 3.5.2 of the EFSA-PLH Guidance on

3. Commodity data

3.1. Description of the commodity

B. thunbergii is a deciduous species therefore, based on the period of export (see Table 4) these are expected to be dormant plants without leaves for most of this period. However, if exported in March, April or October, the plants may have leaves. The age of the plants at the time of export is between 2 and 3 years. The size of the commodity is between 20 and 40 cm tall. All *B. thunbergii* plants are exported as potted plants.

3.2. Description of the production areas

The main production areas of *B. thunbergii* plants for export are located in 14 provinces in Turkey (Figure 2). Forest nurseries located throughout Turkey may be providers of starting material (plantlets) for the ornamental production nurseries.



Figure 2: Main production areas (indicated in green) in Turkey of *Berberis* plants for export (provided by the NPPO of Turkey)

3.3. Production and handling processes

3.3.1. Growing conditions

3.3.2. Source of planting material

Genetic material from registered forest nurseries (Technical dossier on *Berberis* -second submission-, Section 3) is the source of propagation material used by the production nurseries for the production of plants intended for export. There is no other available information on the reproductive material.

3.3.3. Production cycle

Exported plants are 2–3 years old.

Production starts with winter or summer cuttings taken from mother plants. The age of the mother plants, the size of the cuttings and the growing conditions were not specified in the dossier. All stages of the plants are grown in pots with turf on a jute black base without ground connection. However, based on the pictures included in the dossier, it seems that the pots are, at some stages, in contact with soil.

Limited information was provided on any chemical, physical or biological phytosanitary measures adopted during the cultivation period (Additional information provided by NPPO of Turkey, Section 19).

3.3.4. Pest monitoring during production

Forest nurseries affiliated with the General Directorate of Forestry (not directly exporting/importing nurseries) are stated to be inspected by forestry inspectors as a routine work (at least once a month). According to the dossier forest nurseries are inspected once a year for phytosanitary requirements by the Provincial Directorate of Agriculture.

Production nurseries are inspected at least once a year, regardless whether they are exporting or not. According to the dossier, for the identification of viruses, bacteria, fungi and nematodes in the plants to be exported, 1 kg sample is taken from growing media in pots as composite sample. Also, samples from leaves, stems, etc., are to be taken separately by the inspector and send to the laboratory for analysis. In the production nurseries of ornamentals, all plants are to be inspected visually, and samples are taken from symptomatic plants if necessary. There is no information on the frequency of these inspections and on pests identified during the inspections and laboratory testing.

Traded ornamental plants are required to be free from any kind of disease symptoms or pests. No information is provided on actions taken in case a harmful organism is identified in the nursery.

3.3.5. Post-harvest processes and export procedure

The planned production for export in the EU in 2020 was estimated to be 7,950 plants. The months on which the plants are to be exported to the EU are indicated in Table 4 (Dossier, Section 5.4).

Exportation may be done in mixed loads of *Berberis* spp. with other (not specified) species and it is mainly done from production sites in the provinces Adana, Antalya, İzmir and Sakarya.

Plants are loaded on refrigerated trucks for export. The relative humidity content of the loaded trailer is between 85% and 95% and temperature is between 2°C and 4°C. However, from the pictures provided, it is not clear if the trucks shown can ensure these conditions.

The size of the consignment varies according to the age of the plants, the size of the pots and the loading capacity of the trucks. The pots are stacked one by one in a row in the refrigerated trucks. If the plants are located in the production sites of different companies, the exporter company collects the plants to be shipped to its own production area.

Table 4: Scheduling of *Berberis thunbergii* plants planned to be exported to the EU (indicated in grey)

	January	February	March	April	May	June	July	August	September	October	November	December
<i>Berberis</i> L.												

4. Identification of pests potentially associated with the commodity

The search for potential pests associated with *Berberis* spp. rendered 614 species (see Microsoft Excel® file in Appendix C).

4.1. Selection of relevant EU-quarantine pests associated with the commodity

The EU listing of union quarantine pests and protected zone quarantine pests (Commission Implementing Regulation (EU) 2019/2072) is based on assessments concluding that the pests can enter, establish, spread and have potential impact in the EU.

The relevance of an EU-quarantine pest for this opinion was based on evidence that:

- a) the pest is present in Turkey;
- b) *Berberis* spp. is a host of the pest;
- c) one or more life stages of the pest can be associated with the specified commodity.

Pests that fulfilled all criteria were selected for further evaluation.

Table 5 presents an overview of the evaluation of the four EU-quarantine pest species that are reported to use *Berberis* spp. as a host with regard to their relevance for this Opinion.

Of these four EU-quarantine pest species evaluated, one is present in Turkey and was selected for further evaluation as it fulfils the criteria to be selected for further evaluation (*Bemisia tabaci*).

Table 5: Overview of the evaluation of the four EU-quarantine pest species reported in *Berberis* spp.

No.	Pest name according to EU legislation ^(a)	EPPO code	Group	Pest present in Turkey	<i>Berberis</i> spp. confirmed as a host (reference)	Pest can be associated with the commodity	Pest relevant for the opinion
1	<i>Phymatotrichopsis omnivora</i>	PHMPOM	Fungi	No	Yes	Yes	No
2	<i>Phytophthora ramorum</i>	PHYTRA	Oomycete	No	Yes	Yes	No
3	<i>Bemisia tabaci</i>	BEMITA	Insects	Yes	Yes	Yes	Yes
4	<i>Toxoptera citricida</i>	TOXOCI	Insects	No	Yes	Yes	No

(a): Commission Implementing Regulation (EU) 2019/2072.

4.2. Selection of other relevant pests (non-regulated in the EU) associated with the commodity

The information provided by NPPO of Turkey, integrated with the search EFSA performed, was evaluated in order to assess whether there are other potentially relevant pests of *Berberis* spp. present in the country of export. For these potential pests that are non-regulated in the EU, pest risk assessment information on the probability of entry, establishment, spread and impact is usually lacking. Therefore, these pests were also evaluated to determine their relevance for this opinion based on evidence that:

- a) the pest is present in Turkey;
- b) the pest is (i) absent or (ii) has a limited distribution in the EU;
- c) *Berberis* spp. is a host of the pest;
- d) one or more life stages of the pest can be associated with the specified commodity;
- e) the pest may have an impact in the EU.

Based on the information collected, 605 potential pests not regulated in the EU, known to be associated with *Berberis* were evaluated for their relevance to this opinion. Species were excluded from further evaluation when at least one of the conditions listed above (a-e) was not met. Details can be found in Appendix D (Microsoft Excel® file). Of the evaluated pest species not regulated in the EU, one insect species (*Malacosoma parallela*) was selected for further evaluation, because it met all the selection criteria. More information on this pest species can be found in the pest datasheets (Appendix A).

Several *Puccinia* species, including *Puccinia graminis*, are present in the EU, and therefore, the Panel concluded not to select them for further evaluation. However, because of the importance of these cereal rust pathogens for the EU, the panel wants to report the following notes:

- *Berberis* is an alternate host for several rust species, including *P. graminis* and *P. striiformis*.
- *P. graminis* is present in Turkey and reported on *Berberis* species.
- *Berberis thunbergii* is not reported as a host for *P. graminis*.
- Interspecific hybrids of *B. thunbergii* can be a host of *Puccinia graminis* (e.g. Bartaula et al., 2019).

- *P. striiformis* is present in Turkey but not on *Berberis* species.
- It is important to avoid planting of *Berberis* species in proximity to cereal fields.
- New stem rust races could be introduced with the trade of *Berberis* plants.
- Genetic diversity and new virulence combinations can develop on introduced *Berberis* plants.
- Arrival of new stem rust races by wind to Europe can also happen and cannot be prevented.
- *P. graminis* is present in EU and has no quarantine status in EU, but has a quarantine status in Canada and USA.
- Import of and domestic movement of *Berberis* species (including *B. thunbergii*) is regulated in Canada (D-01-04: Plant Protection Import and Domestic Movement Requirements for Barberry (*Berberis*, *Mahoberberis* and spp.) under the Canadian Barberry Certification Program).

4.3. Overview of interceptions

Data on the interception of harmful organisms on plants of *Berberis* spp. can provide information on some of the organisms that can be present on *Berberis* spp. despite the current measures taken. In the EUROPHYT/TRACES database (assessed on April 2022) of interceptions in the EU, there is no record of interceptions on *Berberis* from Turkey (EUROPHYT and TRACES, online).

Bemisia tabaci is the most intercepted pest species on plants for planting in the EU. There were 72 interceptions of *B. tabaci* on different commodities imported into the EU from Turkey, mainly on fruits of *Capsicum annum*. Considering imports of *Berberis* plants from Turkey to the EU, between 1994 and 2022, there are no records of interceptions of *B. tabaci* (EUROPHYT and TRACES, online, [Accessed: 26 April 2022]).

4.4. List of potential pests not further assessed

From the pests not selected for further evaluation, the Panel highlighted two species that can potentially have an impact (see Appendix C) but for which the currently available evidence does not provide reasons for further evaluation in this opinion. The detailed reason is provided for each species in Appendix C.

4.5. Summary of pests selected for further evaluation

The two pests identified to be present in Turkey and can be associated with potted plants of *Berberis* spp. destined for export are listed in Table 6. The effectiveness of the risk mitigation measures applied to the commodity was evaluated for these selected pests.

Table 6: List of relevant pests selected for further evaluation

	Current scientific name	EPPO code	Name used in the EU legislation	Taxonomic information	Group	Regulatory status
1	<i>Bemisia tabaci</i>	BEMITA	<i>Bemisia tabaci</i> (European populations)	Aleyrodidae	Insect	EU protected zone quarantine pest according to Commission Implementing Regulation (EU) 2019/2072
2	<i>Malacosoma parallela</i>	MALAPA	<i>Malacosoma parallela</i>	Lasiocampidae	Insect	No quarantine status in the EU

5. Risk mitigation measures

For each selected pest (Table 6), the Panel assessed the possibility that it could be present in a *Berberis* spp. nursery and assessed the probability that pest freedom of a consignment is achieved by the implemented risk mitigation measures acting on the pest under evaluation.

The information used in the evaluation of the effectiveness of the risk mitigation measures is summarised in a pest datasheet (see Appendix A).

5.1. Possibility of pest presence in the export nurseries

For each pest (Table 6), the Panel evaluated the likelihood that the pest could be present in a *Berberis* spp. nursery by evaluating the possibility that *Berberis* spp. in the export nursery are infested either by:

- introduction of the pest from the environment surrounding the nursery;
- introduction of the pest with new plants/seeds;
- spread of the pest within the nursery.

5.2. Risk mitigation measures applied in Turkey

- With the information provided by the NPPO of Turkey (Dossier sections 5.1, 5.2, and 5.3), the Panel summarised the risk mitigation measures (see Table 7) that are implemented in the production nurseries.

Table 7: Overview of implemented risk mitigation measures for *Berberis* spp. plants designated for export to the EU from Turkey

Number	Risk mitigation measure	Implementation in Turkey
1	Registration of the nursery and Phytosanitary management	Turkey is a member of the International Plant Protection Convention (IPPC) and is obliged to implement the International Standards on Phytosanitary Measures (ISPM) published by the IPPC. All nurseries producing ornamental plants are required to be a member of the ornamental plant grower union in Turkey and inspected at least once a year. A plant passport or export certificate is issued.
2	Phytosanitary certificates and plant passport	Phytosanitary Certificates/Re-Export Phytosanitary Certificates are issued in exportation of plants and plant products with respect to plant health. Plant health inspectors are responsible from exportation and importation controls, sampling and issuing certificates. Nurseries are officially inspected at least once a year and for issuing the export certificate.
3	Growing media	Is composed entirely of peat or fibre of <i>Cocos nucifera</i> L. and has not been previously used for growing plants or for any other agricultural purposes. It is also stored and maintained under appropriate conditions to keep it free from quarantine pests. Appropriate measures are taken to ensure that the growing medium is kept free from Union quarantine pests, including at least: physical isolation of the growing medium from soil and other possible sources of contamination, hygiene measures and using water free from Union quarantine pests.
4	Pesticide application	There is a database for registered pesticides in Turkey. There are no products registered for <i>Berberis</i> . For all crops in Turkey, pesticides are applied according to the technical instructions for plant protection and according to the principles of integrated pest management.
5	Surveillance and monitoring	Both processes are conducted according to Turkish phytosanitary regulations. There are no targeted surveys for the actionable pests.
6	Sampling and laboratory testing	For the identification of viruses, bacteria, fungi and nematodes in the seedlings to be exported, 1 kg sample is taken from growing media in pots as composite sample. Samples from leaves, stems, are taken separately by the inspector and sent to the laboratory for analysis.
7	Refrigeration	Transportation is made with refrigerated trucks. The dispatch is made as pots and the pots are stacked one by one in a row in the truck. The moisture content is between 85% and 95%. Trailers temperature must be between 2°C and 4°C.
8	Preconsignment inspection	Prior to export, planting material for which a Phytosanitary Certificate is to be issued shall be subjected to phytosanitary inspection. Only certified plants for planting may be exported. Phytosanitary inspectors are responsible for export controls, sampling and issuing certificates.

5.3. Evaluation of the current measures for the selected relevant pests including uncertainties

For each pest, the relevant risk mitigation measures acting on the pest were identified. Any limiting factors on the efficacy of the measures were documented. All the relevant information including the related uncertainties deriving from the limiting factors used in the evaluation are summarised in a pest datasheet provided in Appendix A.

Based on this information, for each relevant pest, an expert judgement has been given for the likelihood of pest freedom of commodities taking into consideration the risk mitigation measures acting on the pest and their combination.

An overview of the evaluation of each relevant pest is given in the sections below (Sections 5.3.1–5.3.2). The outcome of EKE on pest freedom after the evaluation of the proposed risk mitigation measures is summarised in Section 5.3.3.

5.3.1. Overview of the evaluation of *Bemisia tabaci*

Rating of the likelihood of pest freedom	Pest free with some exceptional cases (based on the Median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free plants	9,928 out of 10,000 plants	9,950 out of 10,000 plants	9,969 out of 10,000 plants	9,885 out of 10,000 plants	9,997 out of 10,000 plants
Proportion of infested plants	3 out of 10,000 plants	15 out of 10,000 plants	31 out of 10,000 plants	50 out of 10,000 plants	72 out of 10,000 plants
Summary of the information used for the evaluation	The whitefly <i>B. tabaci</i> is a polyphagous pest with a wide host range of more than 1,000 different plant species. <i>B. tabaci</i> is widespread in Turkey and <i>Berberis</i> spp. has been reported as a host of <i>B. tabaci</i> in Turkey. Due to its polyphagous nature the pest can be present in the surrounding environment of the nurseries producing <i>Berberis thunbergii</i>. Plants are mostly grown in the open field and the whitefly could enter the nursery by flight. All life stages of <i>B. tabaci</i> (eggs, larvae, and adults) can be present on the leaves of the plants. There is no export of plants in the spring and summer period (indicated in dossier from April to September). <i>B. thunbergii</i> is a deciduous plant. In general, dormant deciduous plants without leaves are not considered a pathway for <i>B. tabaci</i>. However, it is uncertain if the export period of dormant plants indicated in the dossier excludes the presence of leaves of the exported <i>B. thunbergii</i> plants. <i>B. thunbergii</i> plants traded in March, April or October could have leaves and <i>B. tabaci</i> could be present. Measures taken against the pest and their efficacy The relevant applied measures are: (i) regular inspections in the nurseries (at least 1 inspection per year) (ii) export inspections. No information was provided on targeted treatments against <i>Bemisia tabaci</i> in nurseries producing <i>Berberis</i> plants for export. Interception records <i>B. tabaci</i> has been intercepted on plants from Turkey. There are no records of interceptions of <i>B. tabaci</i> on <i>Berberis</i> plants from Turkey. Shortcomings of current measures/procedures There is no clear indication of a targeted inspections and treatments for <i>B. tabaci</i> in ornamental nurseries producing <i>Berberis</i>. Main uncertainties There is high uncertainty on the exact trading season and the implementation of the risk mitigation measures targeting <i>Bemisia</i> in the nurseries.				

5.3.2. Overview of the evaluation of *Malacosoma parallela*

Rating of the likelihood of pest freedom	Pest free with some exceptional cases (based on the Median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free bundles	9,956 out of 10,000 plants	9,971 out of 10,000 plants	9,982 out of 10,000 plants	9,991 out of 10,000 plants	9,998 out of 10,000 plants
Proportion of infested bundles	2 out of 10,000 plants	9 out of 10,000 plants	18 out of 10,000 plants	29 out of 10,000 plants	44 out of 10,000 plants
Summary of the information used for the evaluation	Possibility that the pest could become associate with the commodity The lepidopteran pest <i>M. parallela</i> is extremely polyphagous and causes most damage in its native range to <i>Quercus</i> spp., <i>Prunus</i> spp. and <i>Malus</i> spp. Significant damage also occurs on various other woody species, including <i>Berberis</i> and many native species of Central Asia. <i>Malacosoma parallela</i> is present in Turkey, with no further details on its distribution. <i>M. parallela</i> can spread by flights of adult moths. All stages of the life cycle can be transported on host plants moving in trade, particularly plants for planting and cut branches. Eggs, larvae and pupae (cocoons) may be associated with wood carrying bark and may be present as contaminants on other commodities. Measures taken against the pest and their efficacy The relevant applied measures are: (i) regular inspections in the nurseries (at least one inspection per year) (ii) export inspections. No information was provided on targeted treatments against <i>M. parallela</i> in nurseries producing <i>Berberis</i> plants for export. Interception records There are no records of interceptions of <i>Berberis</i> plants for planting from Turkey. Shortcomings of current measures/procedures Egg masses might be overlooked by non-trained personnel. Some of the pesticides listed in the dossier might be effective against the moth. However, no details are given on which pesticides are applied from those listed in the Dossier, Section 2.0, on the pesticide application schedule and on the application methods. Main uncertainties – The pest is reported in Turkey with no details on its distribution. – Egg masses might be overlooked by non-trained personnel. – The insecticide applications are not targeted to <i>M. parallela</i> and may not be effective.				

5.3.3. Outcome of Expert Knowledge Elicitation

Table 8 and Figure 3 show the outcome of the EKE regarding pest freedom after the evaluation of the implemented risk mitigation measures for all the evaluated pests. Figure 4 provides an explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the implemented risk mitigation measures for *Berberis thunbergii* plants designated for export to the EU for *Bemisia tabaci*.

Table 8: Assessment of the likelihood of pest freedom following evaluation of current risk mitigation measures against *Bemisia tabaci* and *Malacosoma parallela* on *Berberis* spp. potted plants designated for export to the EU. In panel A, the median value for the assessed level of pest freedom for each pest is indicated by 'M', the 5% percentile is indicated by L and the 95% percentile is indicated by U. The percentiles together span the 90% uncertainty range regarding pest freedom. The pest freedom categories are defined in panel B of the table

Number	Group*	Pest species	Sometimes pest free	More often than not pest free	Frequently pest free	Very frequently pest free	Extremely frequently pest free	Pest free with some exceptional cases	Pest free with few exceptional cases	Almost always pest free
1	Insect	<i>Bemisia tabaci</i>					L	M		U
2	Insect	<i>Malacosoma parallela</i>						LM		U

PANEL A

	Pest freedom category	Pest-free plants out of 10,000		Legend of pest freedom categories	
	Sometimes pest free	≤ 5,000		L	Pest freedom category includes the elicited lower bound of the 90% uncertainty range
	More often than not pest free	5,000 to ≤ 9,000		M	Pest freedom category includes the elicited median
	Frequently pest free	9,000 to ≤ 9,500		U	Pest freedom category includes the elicited upper bound of the 90% uncertainty range
	Very frequently pest free	9,500 to ≤ 9,900			
	Extremely frequently pest free	9,900 to ≤ 9,950			
	Pest free with some exceptional cases	9,950 to ≤ 9,990			
	Pest free with few exceptional cases	9,990 to ≤ 9,995			
	Almost always pest free	9,995 to ≤ 10,000			

PANEL B

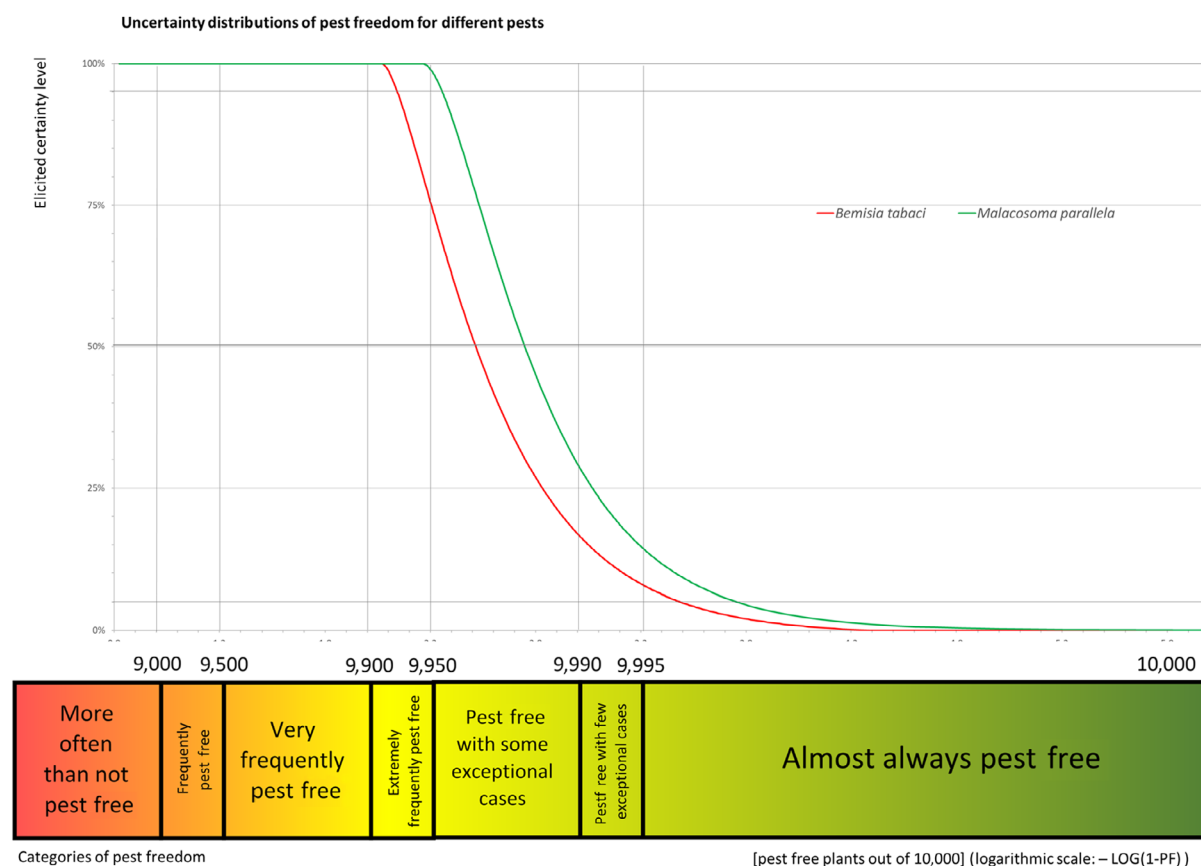


Figure 3: Elicited certainty (y-axis) of the number of pest-free *Berberis* spp. potted plants (x-axis; log-scaled) out of 10,000 plants designated for export to the EU from Turkey for all evaluated pests visualised as descending distribution function. Horizontal lines indicate the percentiles (starting from the bottom 5%, 25%, 50%, 75%, 95%). The Panel is 95% confident that 9,928 and 9,956 or more plants per 10,000 will be free from *Bemisia tabaci* and *Malacosoma parallela*, respectively

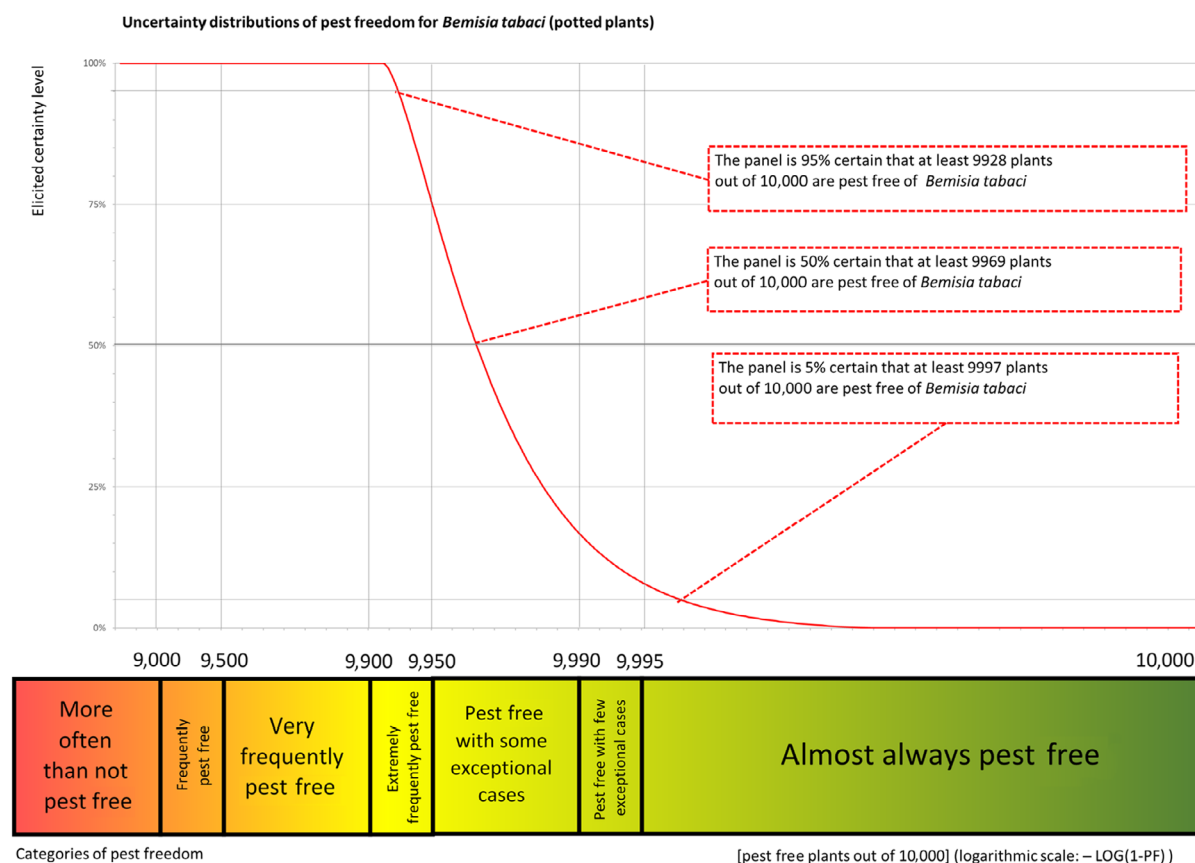


Figure 4: Explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the implemented risk mitigation measures for plants designated for export to the EU based on based on the example of *Bemisia tabaci*

6. Conclusions

There are two pests identified to be present in Turkey and considered to be potentially associated with potted plants of 2–3 years old of *Berberis thunbergii* imported from Turkey and relevant for the EU.

The likelihood of the pest freedom after the evaluation of the implemented risk mitigation measures for potted plants of 2–3 years old of *B. thunbergii*. Designated for export to the EU was estimated.

For *Bemisia tabaci*, the likelihood of pest freedom following the evaluation of current risk mitigation measures, it was estimated as 'Pest free with some exceptional cases' with the 90% uncertainty range reaching from 'Extremely frequently pest free' and to 'Almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,928 and 10,000 plants per 10,000 will be free from *Bemisia tabaci*.

For *Malacosoma parallela*, the likelihood of pest freedom following evaluation of current risk mitigation measures was estimated as 'Pest free with some exceptional cases' with the 90% uncertainty range reaching from 'Pest free with some exceptional cases' to 'Almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,956 and 10,000 plants per 10,000 will be free from *Malacosoma parallela*.

References

- Bartaula R, Melo ATO Kingan S, Jin Y and Hale I, 2019. Mapping non-host resistance to the stem rust pathogen in an interspecific barberry hybrid. BMC Plant Biology, 19, 1–17. <https://doi.org/10.1186/S12870-019-1893-9/TABLES/5>
- CABI (Centre for Agriculture and Bioscience International), online. CABI Crop Protection Compendium. Available online: <https://www.cabi.org/cpc/>
- EFSA PLH Panel (EFSA Panel on Plant Health), 2018. Guidance on quantitative pest risk assessment. EFSA Journal 2018;16(8):5350, 86 pp. <https://doi.org/10.2903/j.efsa.2018.5350>

- EFSA PLH Panel (EFSA Panel on Plant Health), 2019a. Guidance on commodity risk assessment for the evaluation of high risk plants dossiers. EFSA Journal 2019;17(4):5668, 20 pp. <https://doi.org/10.2903/j.efsa.2019.5668>
- EFSA PLH Panel (EFSA Panel on Plant Health), 2019b. Commodity risk assessment of black pine (*Pinus thunbergii* Parl.) bonsai from Japan. EFSA Journal 2019;17(5):5667, 184 pp. <https://doi.org/10.2903/j.efsa.2019.5667>
- EFSA Scientific Committee, 2018. Scientific Opinion on the principles and methods behind EFSA's Guidance on Uncertainty Analysis in Scientific Assessment. EFSA Journal 2018;16(1):5122, 235 pp. <https://doi.org/10.2903/j.efsa.2018.5122>
- EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database. Available online: <https://www.eppo.int/> [Accessed: 30 October 2020].
- EUROPHYT, online. European Union Notification System for Plant Health Interceptions - EUROPHYT. Available online: https://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/index_en.htm [Accessed: 3 April 2021].
- FAO (Food and Agriculture Organization of the United Nations), 1995. ISPM (International standards for phytosanitary measures) No 4. Requirements for the establishment of pest free areas. Available online: <https://www.ippc.int/en/publications/614/>
- FAO (Food and Agriculture Organization of the United Nations), 2016. ISPM (International standards for phytosanitary measures) No. 36. Integrated measures for plants for planting. FAO, Rome, 22 pp. Available online: <https://www.ippc.int/en/publications/636/>
- FAO (Food and Agriculture Organization of the United Nations), 2017. ISPM (International standards for phytosanitary measures) No. 5. Glossary of phytosanitary terms. FAO, Rome. Available online: <https://www.ippc.int/en/publications/622/>
- TRACES-NT, online. TRAdE Control and Expert System. Available online: <https://webgate.ec.europa.eu/tracesnt> [Accessed: 3 April 2021].

Glossary

Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 1995, 2017).
Entry (of a pest)	Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO, 2017).
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2017).
Impact (of a pest)	The impact of the pest on the crop output and quality and on the environment in the occupied spatial units.
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO, 2017).
Measures	Control (of a pest) is defined in ISPM 5 (FAO, 2017) as 'Suppression, containment or eradication of a pest population' (FAO, 1995). Control measures are measures that have a direct effect on pest abundance. Supporting measures are organisational measures or procedures supporting the choice of appropriate risk mitigation measures that do not directly affect pest abundance.
Pathway	Any means that allows the entry or spread of a pest (FAO, 2017).
Phytosanitary measures	Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO, 2017).
Protected zone	A Protected zone is an area recognised at EU level to be free from a harmful organism, which is established in one or more other parts of the Union.
Quarantine pest	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (FAO, 2017).
Regulated non-quarantine pest	A non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party (FAO, 2017).
Risk mitigation measure	A measure acting on pest introduction and/or pest spread and/or the magnitude of the biological impact of the pest should the pest be present. A risk mitigation measure may become a phytosanitary measure, action or procedure according to the decision of the risk manager.
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO, 2017)

Abbreviations

CABI	Centre for Agriculture and Bioscience International
EKE	Expert Knowledge Elicitation
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
FUN	Fungi
INS	Insect
ISPM	International Standards for Phytosanitary Measures
NEM	Nematode
PLH	Plant Health
PRA	Pest Risk Assessment
RNQPs	Regulated Non-Quarantine Pests

Appendix A – Data sheets of pests selected for further evaluation via expert knowledge elicitation

A.1. *Bemisia tabaci*

A.1.1. Organism information

Taxonomic information	Current valid scientific name: <i>Bemisia tabaci</i> (Gennadius, 1889) Synonyms: <i>Aleurodes inconspicua</i>, <i>Aleurodes tabaci</i>, <i>Bemisia achyranthes</i>, <i>Bemisia bahiana</i>, <i>Bemisia costa-limai</i>, <i>Bemisia emiliae</i>, <i>Bemisia goldingi</i>, <i>Bemisia gossypiperda</i>, <i>Bemisia gossypiperda mosaivectura</i>, <i>Bemisia hibisci</i>, <i>Bemisia inconspicua</i>, <i>Bemisia longispina</i>, <i>Bemisia lonicerae</i>, <i>Bemisia manihotis</i>, <i>Bemisia minima</i>, <i>Bemisia minuscula</i>, <i>Bemisia nigeriensis</i>, <i>Bemisia rhodesiaensis</i>, <i>Bemisia signata</i>, <i>Bemisia vayssieri</i> Name used in the EU legislation: <i>Bemisia tabaci</i> Genn. (non-European populations) known to be vector of viruses [BEMITA] Order: Hemiptera Family: Aleyrodidae Common name: tobacco whitefly Name used in the Dossier: <i>Bemisia tabaci</i>
Group	Insects
EPPO code	BEMITA
Regulated status	The pest is listed in Annex II/A of Regulation (EU) 2019/2072 as <i>Bemisia tabaci</i> Genn. (non-European populations) known to be vector of viruses [BEMITA], and in Annex III as protected zone quarantine pest (European populations).
Pest status in Turkey	Widespread (EPPO global database), the formerly defined Biotypes B and Q (now species considered as MEAM1 and MED) are present in Turkey (EFSA, 2013).
Host status on <i>Berberis</i>	<i>Berberis</i> species are reported as host plants for <i>B. tabaci</i> (Bayhan et al., 2006; EFSA, 2013; Li et al., 2011). In Turkey, it is also reported as a pest in cotton and vegetable crops (Bayhan et al., 2006). <i>B. tabaci</i> is highly polyphagous, and therefore, the panel assumes that <i>B. thunbergii</i> can be a host for <i>B. tabaci</i> .
PRA information	EFSA Scientific Opinion on the risks to plant health posed by <i>Bemisia tabaci</i> species complex and viruses it transmits for the EU territory (EFSA PLH Panel, 2013). <i>B. tabaci</i> was identified as an actionable pest for the commodity risk assessment of <i>Lonicera</i> plants from Turkey (EFSA, 2022).

Other relevant information for the assessment

B. tabaci is a complex of at least 28 indistinguishable morphocryptic species. Twenty-six of them, endemic in countries around the world, are so far not reported in Europe (EFSA PLH Panel, 2013). The terms 'European populations' and 'non-European populations' of *B. tabaci* used in the Regulation (EU) 2019/2072 do not refer to specific populations or taxonomic entities but stipulate a geographic origin of *B. tabaci*, from inside and outside Europe, respectively. In Regulation (EU) 2019/2072, Turkey is considered as European. In this respect, *B. tabaci* populations in Turkey are considered to be European populations. In the EU, non-European populations of *B. tabaci* have a quarantine status, while European populations have a quarantine status for specified protected zones.

Biology	During oviposition, females insert eggs with the pedicel directly into leaf tissue (Paulson and Beardsley, 1985). It has four instars. The first instar with legs, called crawler, finds a permanent spot on a leaf and stays there for the rest of its nymphal development (Walker et al., 2009). The pest is a phloem-feeder and can be found mainly on leaves (Cohen et al., 1996). <i>B. tabaci</i> has a high reproductive potential and each female can lay an average of 80 to more than 300 eggs during their lifetime. The number of eggs laid depends on temperature and the host plant, but generally under favourable conditions (e.g. tomato production in greenhouses) even the introduction of only a few founding insects will lead to a massive upsurge in insect densities. Under these conditions, four to five insect generations per year can develop (EFSA, 2013). <i>B. tabaci</i> adults can have directional and active flights. Whiteflies seldom need to fly more than a few centimetres to a few metres to find suitable host plants. However, they may cover distances of a few kilometres. <i>B. tabaci</i> adults can spread over longer distances by passive transport with wind.
----------------	---

Symptoms	Main type of symptoms	Wide range of symptoms can occur on plants due to direct feeding of the pest, contamination of honeydew and sooty moulds, transmitted viruses and phytotoxic responses. Plants exhibit one or more of these symptoms: chlorotic spotting, vein yellowing, intervein yellowing, leaf yellowing, yellow blotching of leaves, yellow mosaic of leaves, leaf curling, leaf crumpling, leaf vein thickening, leaf enations, leaf cupping, stem twisting, plant stunting, wilting, leaf loss and silvering of leaves (CABI, online; EPPO, 2004).
	Presence of asymptomatic plants	No asymptomatic period is known to occur in the infested plants. However, eggs and first-instar larvae are difficult to detect. Symptoms of the infestation by the insect are visible.
	Confusion with other pathogens/pests	<i>B. tabaci</i> can be easily confused with other species such as glasshouse whitefly <i>Trialeurodes vaporariorum</i> , <i>B. afer</i> , <i>T. lauri</i> , <i>T. packardii</i> , <i>T. ricini</i> and <i>T. variabilis</i> . A microscopic slide is needed for morphological identification (EPPO, 2004).
Host plant range	<i>B. tabaci</i> is a polyphagous pest with a wide host range, including more than 1,000 different plant species (Abd-Rabou and Simmons, 2010). Some species of <i>Berberis</i> are hosts of the pest.	
Evidence that the commodity can be a pathway	All life stages of <i>B. tabaci</i> (eggs, larvae and adults) are present on the leaves of the plants. Therefore, plants without leaves are not considered a pathway for <i>B. tabaci</i> . However, if plants are traded with leaves, this could be a pathway for <i>B. tabaci</i> . It is possible that <i>Berberis</i> plants exported from Turkey to the EU could be exported with leaves.	
Surveillance information	In dossier Section 1.5.3, it is stated that the site of production has been found free from <i>B. tabaci</i> on official inspections carried out at appropriate times to detect the pest.	

A.1.2. Possibility of pest presence in the nursery

A.1.2.1. Possibility of entry from the surrounding environment

Bemisia tabaci is a polyphagous species that is widespread in Turkey and reported occurring in many horticultural crops. *Berberis* plants are grown in open field nurseries. Flying adults of *Bemisia tabaci*, able to fly or be transferred by the wind over kilometres, can enter the nursery from host plants that might be present in the surrounding environment.

Uncertainties:

It is not known what is the pressure of the *B. tabaci* population in the surrounding environment of the nursery.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pest to enter the nursery from the surrounding environment.

A.1.2.2. Possibility of entry with new plants/seeds

Bemisia tabaci could enter the nursery with infested propagation material of host plants species.

Uncertainties:

- The origin of the propagation material in relation to the infested areas;
- The presence and the numbers of other host plants in the export nursery

Taking into consideration the above evidence and uncertainties, the Panel considers it is possible that the pest could enter the nursery with new plants.

A.1.2.3. Possibility of spread within the nursery

Flying adults can spread from infested host plants within the nursery.

Uncertainties: There are no uncertainties.

Taking into consideration the above evidence and uncertainties, the Panel considers that the transfer of the pest within the nursery is possible.

A.1.3. Information from interceptions

Bemisia tabaci is the most intercepted pest species on plants for planting in the EU. There were 72 interceptions of *B. tabaci* on different commodities imported into the EU from Turkey, mainly on *Capsicum annum*. Considering imports of *Berberis* plants from Turkey to the EU, between 1994 and 2022, there are no records of interceptions of *B. tabaci* (EUROPHYT and TRACES, online, [Accessed: 4 May 2022]).

A.1.4. Evaluation of the risk mitigation options

In the table below, all risk mitigation measures currently applied in Turkey are listed and described and an indication of their effectiveness on *B. tabaci* is provided.

The possibility of the presence of *B. tabaci* on potted plants and the control effect of the risk mitigation measures applied was already assessed for Lonicera plants to be exported to the EU (EFSA, 2022). Therefore, the panel assessed the differences of the production areas, production methods and pest management actions and time of export between of Lonicera and Berberis production in Turkey. The panel concluded that there were only minor differences between the production systems of Berberis and Lonicera in Turkey which had no significant effect on the evaluation of the level of pest freedom of the exported plants. Therefore, the results of the Expert Knowledge Elicitation for *B. tabaci* from the Lonicera dossier (deciduous Lonicera) were used for the estimation of pest freedom of *B. tabaci* on deciduous *B. thunbergii* from Turkey.

No.	Risk mitigation measure (name)	Description	Effective	Evaluation/ Uncertainties
1	Certified material	Turkey is a member of the International Plant Protection Convention (IPPC) and is obliged to implement the International Standards on Phytosanitary Measures (ISPM) published by the IPPC.	Yes	Plants originate from certified nurseries.
2	Phytosanitary certificates and plant passport	Phytosanitary Certificates/Re-Export Phytosanitary Certificates are issued in exportation of plants and plant products with respect to plant health. Plant health inspectors are responsible from exportation and importation controls, sampling and issuing certificates.	Yes	Uncertainties Information is not sufficient to judge the quality of inspections, etc.).
3	Growing media	Is composed entirely of peat or fibre of <i>Cocos nucifera</i> L. and has not been previously used for growing plants or for any other agricultural purposes. It is also stored and maintained under appropriate conditions to keep it free from quarantine pests.	No	<i>B. tabaci</i> is present on leaves only.
4	Pesticide application	For all crops in Turkey, pesticides are applied according to the Technical Instructions for Plant Protection and according to the principles of integrated pest management. A list of pesticide active ingredients and doses authorised on ornamental plants was provided. No details on frequencies of application have been provided.	Yes	Among the insecticides listed, there are active ingredients that can be effective against <i>B. tabaci</i> . Uncertainties: The frequency of application is not known.

No.	Risk mitigation measure (name)	Description	Effective	Evaluation/ Uncertainties
5	Surveillance and monitoring	Both processes are conducted according to Turkish phytosanitary regulations. Nurseries are inspected once per year.	Yes	Symptoms of <i>B. tabaci</i> infestations could be detected. Uncertainties: The details of surveillance and monitoring are not given (e.g. number of plants, intensity of surveys and inspections, etc.).
6	Sampling and laboratory testing	For the identification of viruses, bacteria, fungi and nematodes in the seedlings to be exported, 1 kg sample is taken from growing media in pots as composite sample. Also samples from leaves, stems, etc., are taken separately by the inspector and send to the laboratory for analysis. The seedlings in the production area are examined macroscopically for pests.	No	
7	Refrigeration	Transportation is made with refrigerated trucks. The dispatch is made as pots (piece) and the pots are stacked one by one in a row in the truck. The moisture content is between 85% and 95%. Trailers temperature must be between 2°C and 4°C.	Yes	Low temperatures can slow down its development but not kill the insect Uncertainties: No uncertainties
8	Pre-consignment inspection	Prior to export, planting material for which a Phytosanitary Certificate is to be issued shall be subjected to phytosanitary inspection. Only certified plants for planting may be exported. Phytosanitary inspectors are responsible for export controls, sampling and issuing certificates.	Yes	Symptoms and presence of <i>B. tabaci</i> infestations could be detected. Uncertainties: Information is not sufficient to judge the quality of inspections.

A.1.4.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

- There are targeted inspections and treatments for *B. tabaci*.
- The pest population pressure in the surrounding environment is very low.
- Suitable hosts are not widely distributed in the production area.
- Plants are traded in the months when population level of *Bemisia* is very low.
- Weed control in the nurseries prevent overwintering populations of *Bemisia*.

A.1.4.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

- There are nurseries producing *Berberis* spp. plants located in the area where *B. tabaci* is present in high populations.
- There are suitable hosts in the production area, in close proximity with *Berberis* plants.
- The pest could go undetected during inspections of the nursery and no specific treatments are applied.
- The exported *Berberis* species are mostly not in dormant stage (if traded in March/April or in October) and they have leaves.
- Population level of *Bemisia* in March, April and October could be high.
- Lack of effective weed control in the nurseries does not prevent the introduction of *Bemisia* from overwintering populations on weeds.

A.1.4.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

- The trade of the *Berberis* plants takes place in seasons when the activity of *B. tabaci* is very low.
- In general, plants are expected to have no leaves at the time of export, but plants traded in March/April or October could have leaves.

A.1.4.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

- We express high uncertainty on the exact trading season and the implementation of the risk mitigation measures targeting *Bemisia* in the nurseries.

A.1.5. Elicitation outcomes of the assessment of the pest freedom for *Bemisia tabaci* on *Berberis thunbergii* plants

Table A.1: Elicited and fitted values of the uncertainty distribution of pest infestation by *Bemisia tabaci* per 10,000 plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	1					15		30		50					80
EKE	1.01	1.86	3.26	6.07	9.9	14.7	19.7	30.5	42.7	49.6	57.4	65	72	76	80

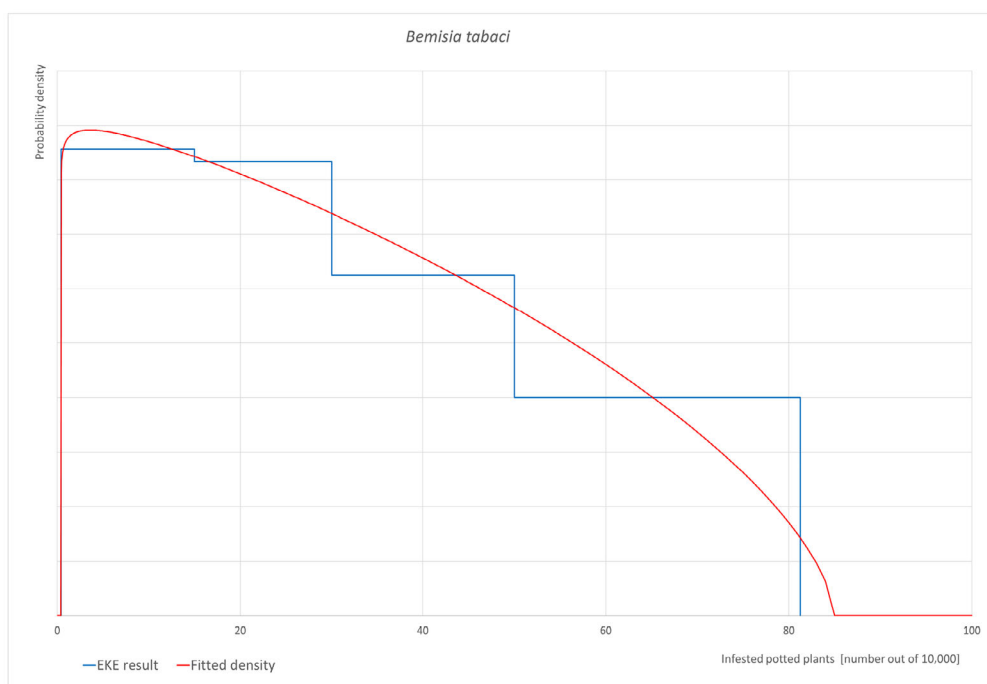
The EKE results are *BetaGeneral* (1.0242, 1.6196, 0.42, 85) fitted with @Risk version 7.6.

Based on the numbers of estimated infested grafted plants, the pest freedom was calculated (i.e. = 10,000 – the number of infested plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.2.

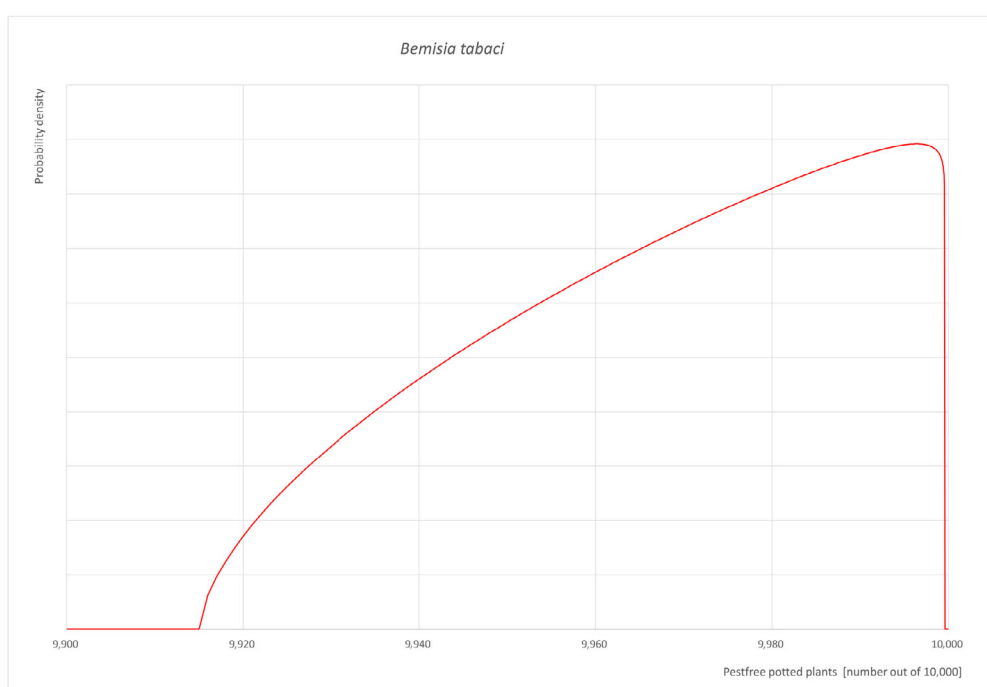
Table A.2: The uncertainty distribution of plants free of *Bemisia tabaci* per 10,000 plants calculated by Table A.1

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,920					9,950		9,970		9,985					9,999
EKE results	9,920	9,924	9,928	9,935	9,943	9,950	9,957	9,969	9,980	9,985	9,990	9,994	9,997	9,998	9,999

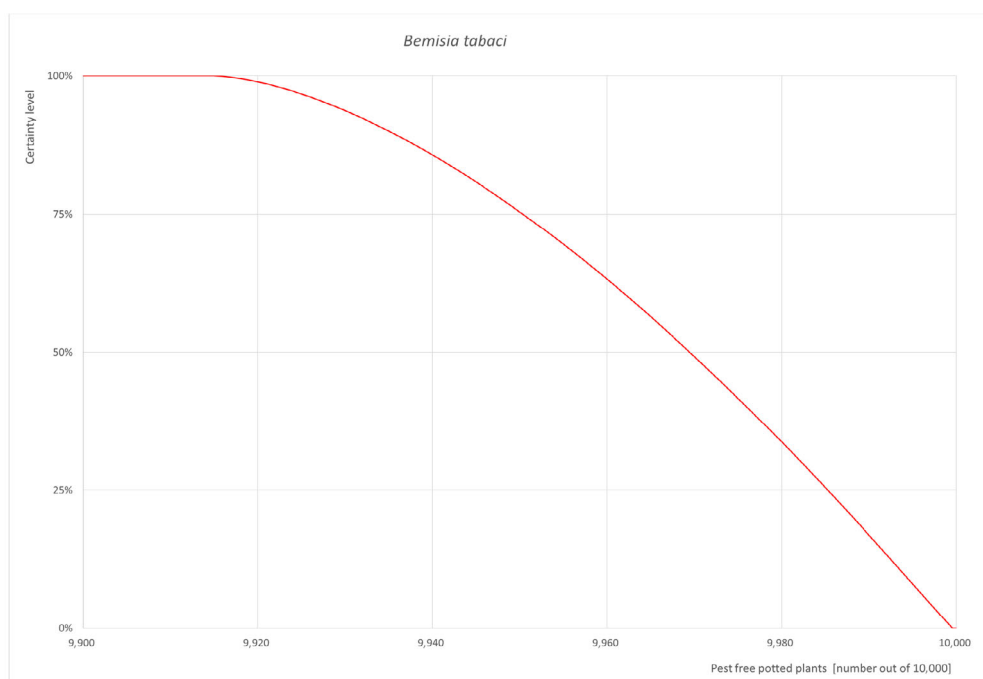
The EKE results are the fitted values.



(a)



(b)



(c)

Figure A.1: (a) Elicited uncertainty of pest infestation per 10,000 deciduous plants for *Bemisia tabaci* complex (histogram in blue—vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free grafted plants per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 plants

A.1.6. Reference list

- Abd-Rabou S and Simmons AM, 2010. Survey of reproductive host plants of *Bemisia tabaci* (Hemiptera: Aleyrodidae) in Egypt, including new host records. *Entomological News*, 121, 456–465. <https://doi.org/10.3157/021.121.0507>
- CABI (Centre for Agriculture and Bioscience International), online. Datasheet *Bemisia tabaci* (tobacco whitefly). Available online: <https://www.cabi.org/cpc/datasheet/8927> [Accessed: 19 October 2021].
- CABI (Centre for Agriculture and Bioscience International), online. Datasheet *Bemisia tabaci* MEAM10 (silverleaf whitefly). Available online: <https://www.cabi.org/cpc/datasheet/8925> [Accessed: 19 October 2021].
- Cohen AC, Henneberry TJ and Chu CC, 1996. Geometric relationships between whitefly feeding behaviour and vascular bundle arrangements. *Entomologia Experimentalis et Applicata*, 78, 135–142. <https://doi.org/10.1111/j.1570-7458.1996.tb00774.x>
- De Barro PJ, Liu S-s, Boykin LM and Dinsdale AB, 2011. *Bemisia tabaci*: a statement of species status. *Annual Review of Entomology*, 56, 1–19. <https://doi.org/10.1146/annurev-ento-112.408-085504>
- EFSA PLH Panel (EFSA Panel on Plant Health), 2013. Scientific Opinion on the risks to plant health posed by *Bemisia tabaci* species complex and viruses it transmits for the EU territory. *EFSA Journal* 2013;11(4):3162, 45 pp. <https://doi.org/10.2903/j.efsa.2013.3162>
- EPPO (European and Mediterranean Plant Protection Organization), online_a. EPPO A2 List of pests recommended for regulation as quarantine pests, version 2019–09. Available online: https://www.eppo.int/ACTIVITIES/plant_quarantine/A2_list [Accessed: 19 October 2021].
- EPPO (European and Mediterranean Plant Protection Organization), online_b. *Bemisia tabaci* (BEMITA). Available online: <https://gd.eppo.int/taxon/BEMITA> [Accessed: 19 October 2021].
- EPPO (European and Mediterranean Plant Protection Organization), 2004. PM 7/35. *Bemisia tabaci*. *OEPP/EPPO Bulletin*, 34, 155–157.
- EUROPHYT, online. European Union Notification System for Plant Health Interceptions - EUROPHYT. Available online: https://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/index_en.htm [Accessed: April 2022].

- Li SJ, Xue X, Ahmed MZ, Ren SX, Du YZ, Wu JH, Cuthbertson AGS and Qiu BL, 2011. Host plants and natural enemies of *Bemisia tabaci* (Hemiptera: Aleyrodidae) in China. *Insect Science*, 18, 101–120. <https://doi.org/10.1111/j.1744-7917.2010.01395.x>
- Paulson GS and Beardsley JW, 1985. Whitefly (Hemiptera: Aleyrodidae) egg pedicel insertion into host plant stomata. *Annals of the Entomological Society of America*, 78, 506–508. <https://doi.org/10.1093/aesa/78.4.506>
- TRACES-NT, online. TRAdE Control and Expert System. Available online: <https://webgate.ec.europa.eu/tracesnt> [Accessed: April 2022].
- Yassin MA and Bendixen LE, 1982. Weed hosts of the cotton whitefly (*Bemisia tabaci* (Genn.)) Homoptera Aleyrodidae. Research Bulletin 1,144. The Ohio State University – Ohio Agricultural Research and Development Center. Available online: https://kb.osu.edu/bitstream/handle/1811/62967/1/OARDC_research_bulletin_n1144.pdf
- Walker GP, Perring TM and Freeman TP, 2009. Life history, functional anatomy, feeding and mating behaviour. In Stansly PA and Naranjo SE (eds.), *Bemisia: Bionomics and management of a global pest*. Springer, Dordrecht, Netherlands. pp. 109–160. https://doi.org/10.1007/978-90-481-2,460-2_4

A.2. *Malacosoma parallela*

A.2.1. Organism information

Taxonomic information	Current valid scientific name: <i>Malacosoma parallela</i> Staudinger Synonyms: <i>Bombyx neustria</i> var. <i>parallela</i> Staudinger, 1887 (Zolotuhin and Zahiri, 2008) Name used in the EU legislation: – Order: Lepidoptera Family: Lasiocampidae Common name: mountain ring silk moth Name used in the Dossier: <i>Malacosoma parallela</i>
Group	Insects
EPPO code	MALAPA
Regulated status	The pest is included in the EPPO A2 list (EPPO, online).
Pest status in Turkey	<i>Malacosoma parallela</i> is present in Turkey, with no further details on its distribution (EPPO, online; CABI).
Pest status in the EU	<i>Malacosoma parallela</i> is absent in the EU.
Host status on <i>Berberis</i>	<i>Berberis</i> species are reported as a host of <i>Malacosoma parallela</i> (EPPO, online).
PRA information	EPPO Pest Risk Assessments available (EPPO, online): • Pest Risk Management report • Report of a Pest Risk Assessment • Pest Risk Assessment Scheme <i>M. parallela</i> was identified as an actionable pest in the EFSA commodity risk assessment of <i>Malus domestica</i> plants from Turkey (EFSA, 2022)

Other relevant information for the assessment

Biology	Larvae of the moth are a notorious defoliating pest of forest trees. In its current area of distribution, main outbreaks of <i>M. parallela</i> occur in mountain forests at an altitude of 1,000–1,800 m where the pest finds optimal conditions for its development. It can occur up to 2,400 m. Flight peaks of <i>M. parallela</i> usually occur between June and July, depending on altitude. The moth completes one generation per year. Adults have a crepuscular behaviour. Copulation occurs 2–3 h after emergence of the adults. Eggs are laid in groups; egg masses usually contain from 100 to 400 eggs covered by a thick layer of special female secretion (spumaline), which is shining whitish grey and silvery when fresh and then turns dark. Egg masses are laid around thin branches of host plants. The layer of secretion protects eggs against unfavourable conditions during overwintering. One female usually makes one egg mass, but sometimes two or three.
----------------	---

	Neonate larvae appear from the end of March at the same time as young leaves of host plants. Usually all hatch during 1–2 days and begin to make a web nest on branches. They feed on young leaves around the nest. The nest is usually constructed by the group of individuals hatched from one egg mass. It can be up to 25 cm long and 17 cm wide. When caterpillars reach third or fourth instar, the group usually leaves the first nest and constructs new ones (two or three) in places where there is more food. Larvae moult inside nests and feed on leaves around the nest. They leave the nests at the fifth or sixth instar and then continue to live individually. The length of their development time depends much on the altitude and host plant. Larvae moult five times before making cocoons on leaves and in other different places at the end of May and in June (Grechkin, 1956; Degtyareva, 1964; Sarkissyan, 1972; Romanenko, 1981; Maslov, 1988).	
Symptoms	Main type of symptoms	Defoliation of host plants is usually very spectacular. The presence of egg masses, nests and individual caterpillars is easily detected. Moths are attracted by sources of light
	Presence of asymptomatic plants	No, if present the pest is easy to detect
	Confusion with other pests	Egg masses encircle thin branches of host plants similar to the egg masses of the closely related European species <i>Malacosoma neustria</i> .
Host plant range	<i>M. parallela</i> is extremely polyphagous and causes most damage in its native range to <i>Quercus</i> spp., <i>Prunus</i> spp. and <i>Malus</i> spp. Significant damage also occurs on various other woody species, including many native species of Central Asia: <i>Berberis integerrima</i>, <i>Chaenomeles japonica</i>, <i>Cotoneaster insignis</i>, <i>Cotoneaster suavis</i>, <i>Crataegus hissarica</i>, <i>Crataegus pontica</i>, <i>Crataegus turkestanica</i>, <i>Cydonia oblonga</i>, <i>Prunus armeniaca</i>, <i>Prunus avium</i>, <i>Prunus cerasus</i>, <i>Prunus divaricata</i>, <i>Prunus mahaleb</i>, <i>Prunus padus</i>, <i>Prunus persica</i>, <i>Pyrus communis</i>, <i>Rosa canina</i>, <i>Rosa corymbifera</i>, <i>Rosa kokanica</i>, <i>Rosa maracandica</i>, <i>Salix excelsa</i>, <i>Salix tenuijulis</i>, <i>Sorbus persica</i>, <i>Sorbus turkestanica</i>. Other native and planted deciduous trees and shrubs are damaged occasionally: <i>Atraphaxis pyrifolia</i>, <i>Elaeagnus angustifolia</i>, <i>Fraxinus sogdiana</i>, <i>Hippophae rhamnoides</i>, <i>Juglans regia</i>, <i>Lonicera korolkowii</i>, <i>Lonicera nummulariifolia</i>, <i>Myricaria bracteata</i>, <i>Populus alba</i>, <i>Populus tremula</i>, <i>Ribes nigrum</i>, <i>Ribes rubrum</i>, <i>Rubus idaeus</i>, <i>Rubus turkestanicus</i> and <i>Ulmus minor</i> (Pavlovskii and Shtakelberg, 1955; Grechkin, 1956; Degtyareva, 1964; Sarkissyan, 1972; Romanenko, 1981; Maslov, 1988).	
Reported evidence of impact	<i>M. parallela</i> is an important defoliator of many deciduous trees in different countries in Eastern Europe, Central Asia (Armenia, Tajikistan). Outbreaks often last for two consecutive years. It was especially noted as a very dangerous pest of oak in the mountains of Armenia (Sarkissyan, 1972) and of forests, fruit trees and shrubs of <i>Rosaceae</i>, <i>Fagaceae</i> and <i>Elaeagnaceae</i> in the mountains of Tajikistan (Grechkin, 1956; Degtyareva, 1964). It attacks both stressed and healthy trees of different ages. Outbreaks occur throughout large mountain areas, often resulting in 100% defoliation and sometimes leading to the death of trees and forests. Damage may be caused by this species alone, or in association with <i>Yponomeuta padellus</i>, <i>Euproctis kargalica</i>, <i>Erschoviella musculana</i>, <i>Lymantria dispar</i> or other defoliators. Attacks may result in serious changes in the environment over large areas, including problems of erosion.	
Pathways and evidence that the commodity is a pathway	All stages of the life cycle can be transported on host plants moving in trade, particularly plants for planting and cut branches. Eggs, larvae and pupae (cocoons) may be associated with wood carrying bark.	
Surveillance information	No surveillance information is currently available from the Turkish NPPO.	

A.2.2. Possibility of pest presence in the nursery

A.2.2.1. Possibility of entry from the surrounding environment

If present in the surroundings, the pest can enter the nursery as Turkey is producing *Berberis* plants for planting outdoors. The pest could enter the nursery mainly by active dispersal (flight). Being highly polyphagous, the pest could be associated with many host plants occurring in the surroundings.

Uncertainties:

- No data available on the distribution of the pest or population densities in the areas of production in Turkey.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pest to enter the nursery.

A.2.2.2. Possibility of entry with new plants/seeds

The pest (larvae, pupae and mainly eggs) can be transported on host plants, particularly plants for planting and cut branches. The presence of the pest can be easily detected by visual inspection; however, egg masses can be overlooked by non-trained personnel.

Uncertainties:

- Uncertain if certified material is inspected for this pest

Taking into consideration the above evidence and uncertainties, the Panel considers it possible that the pest could enter the nursery, though unlikely because all stages can be detected by visual inspection.

A.2.2.3. Possibility of spread within the nursery

If the pest enters the nursery from the surroundings, it could spread either by adult flight, larval movement or infested plant material. Active dispersal of larvae is possible especially if plants are touching with each other (as in stoolbeds). Given that the pest is polyphagous, the pest could be associated with other host plants produced in the nursery.

Taking into consideration the above evidence, the Panel considers that the transfer of the pest within the nursery is possible.

A.2.3. Information from interceptions

There are no records of interceptions of *Berberis* plants from Turkey due to the presence of *M. parallela* between 1994 and April 2022 (EUROPHYT and TRACES-NT, online).

A.2.4. Evaluation of the risk mitigation options

In the table below, all risk mitigation measures currently applied in Turkey are listed and an indication of their effectiveness on *M. parallela* is provided. The description of the risk mitigation measures currently applied in Turkey is provided in Table 6.

No.	Risk mitigation measure (name)	Description	Effective	Evaluation/Uncertainties
1	Certified material	Turkey is a member of the International Plant Protection Convention (IPPC) and is obliged to implement the International Standards on Phytosanitary Measures (ISPM) published by the IPPC.	Yes	Uncertainties: The details of the certification process are not given (e.g. number of plants, intensity of surveys and inspections, etc.).
2	Phytosanitary certificates and plant passport	Phytosanitary Certificates/Re-Export Phytosanitary Certificates are issued in exportation of plants and plant products with respect to plant health. Plant health inspectors are responsible from exportation and importation controls, sampling and issuing certificates.	Yes	Uncertainties: Information is not sufficient to judge the quality of inspections, etc.
3	Growing media	Is composed entirely of peat or fibre of <i>Cocos nucifera</i> L. and has not been previously used for growing plants or for any other agricultural purposes. It is also stored and maintained under appropriate conditions to keep it free from quarantine pests.	No	<i>M. parallela</i> is present on leaves only.

No.	Risk mitigation measure (name)	Description	Effective	Evaluation/Uncertainties
4	Pesticide application	For all crops in Turkey, pesticides are applied according to the Technical Instructions for Plant Protection and according to the principles of integrated pest management. A list of pesticide active ingredients and doses authorised on ornamental plants was provided. No details on frequencies of application have been provided.	Yes	Uncertainties: The frequency of application is not known.
5	Surveillance and monitoring	Both processes are conducted according to Turkish phytosanitary regulations. Nurseries are inspected once per year.	Yes	Potential <i>M. parallela</i> infestations could be easily detected, though egg masses might be overlooked by non-trained personnel. Uncertainties: Specific figures on the intensity of survey (sampling effort) are not provided.
6	Sampling and laboratory testing	For the identification of viruses, bacteria, fungi and nematodes in the seedlings to be exported, 1 kg sample is taken from growing media in pots as composite sample. Also samples from leaves, stems, etc., are taken separately by the inspector and send to the laboratory for analysis. The seedlings in the production area are examined macroscopically for pests.	No	
7	Refrigeration	Transportation is made with refrigerated trucks. The dispatch is made as pots (piece) and the pots are stacked one by one in a row in the truck. The moisture content is between 85% and 95%. Trailers temperature must be between 2°C and 4°C.	Yes	Low temperatures can slow down its development but not kill the insect
8	Pre-consignment inspection	Prior to export, planting material for which a Phytosanitary Certificate is to be issued shall be subjected to phytosanitary inspection. Only certified plants for planting may be exported. Phytosanitary inspectors are responsible for export controls, sampling and issuing certificates.	Yes	The presence of <i>M. parallela</i> infestations could be detected. Information is not sufficient to assess the quality of inspections.

A.2.4.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

- Limited distribution/climatic restrictions.
- All material is produced within the nurseries.
- Insecticides are effective against eggs, larvae and adults.
- Natural enemies are present in the environment.
- Visual inspection is performed by trained personnel.
- Control of mother plants.

A.2.4.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

- Berberis is a preferred host.
- Spread to more areas in Turkey/no climatic restrictions.
- Most of the propagation material is produced in other nurseries.
- Natural and human-assisted dispersal play a role in spreading the pest.
- Insecticides are not effective against eggs, larvae and adults.
- Natural enemies are not present or affected by pesticide treatments.
- Inspections are not effective in identifying pest presence.

A.2.4.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

Due to the limited information available about pest presence and pressure in the nursery area, the panel considers lower values for being as likely as higher values.

A.2.4.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

Main uncertainties:

- Data on efficacy of inspections are limited.
- Timing of insecticide applications is unclear.
- Pest pressure in the nursery areas is not known.

A.2.4.5. Elicitation outcomes of the assessment of the pest freedom for *Malacosoma parallela*

The following tables show the elicited and fitted values for pest infestation (Table A.3) and pest freedom (Table A.4).

Table A.3: Elicited and fitted values of the uncertainty distribution of pest infestation by *Malacosoma parallela* per 10,000 plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					9		17		30					50
EKE	0.379	0.906	1.76	3.43	5.68	8.51	11.5	17.8	25.1	29.4	34.3	39.2	44.0	47.3	50.1

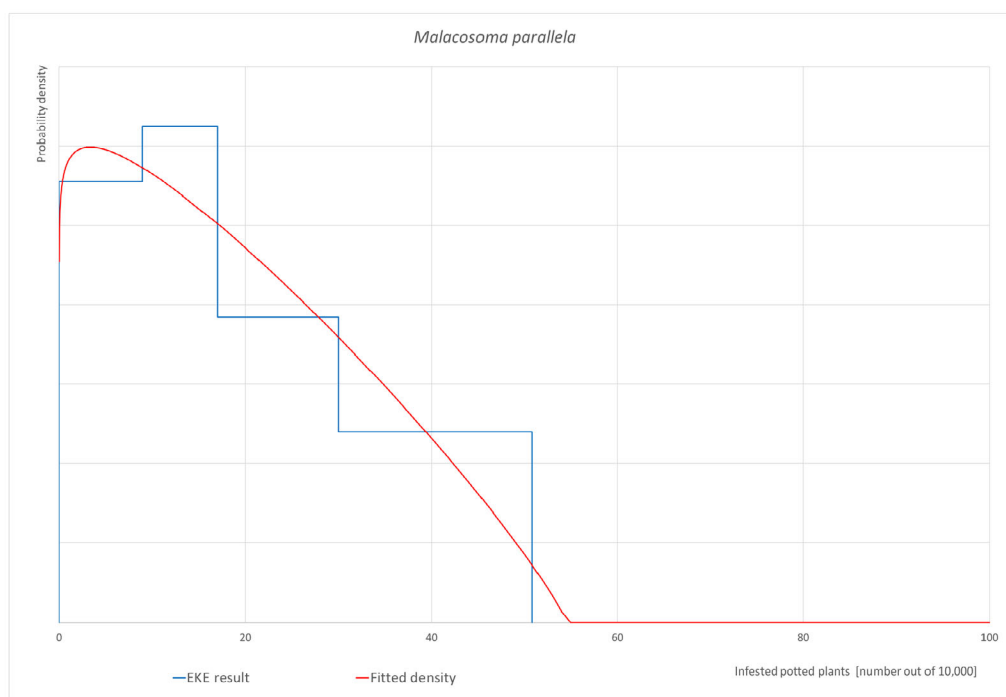
The EKE results are the *BetaGeneral* (1.0569, 1.8654, 0, 54.5) distribution fitted with @Risk version 7.6.

Based on the numbers of estimated infested plants, the pest freedom was calculated (i.e. = 10,000 – number of infested plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.4.

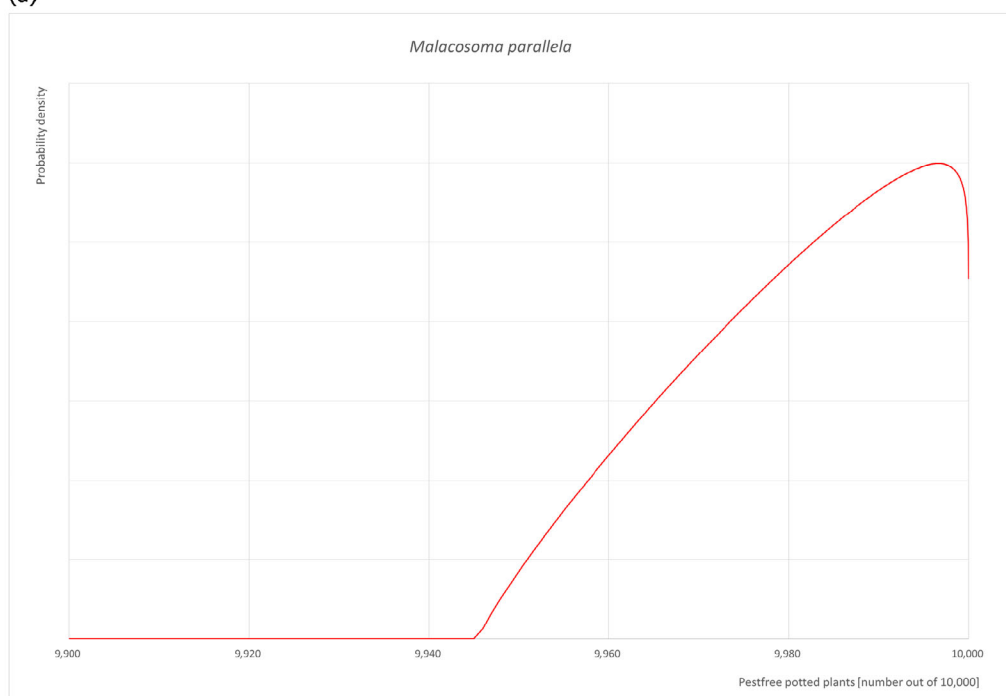
Table A.4: The uncertainty distribution of plants free of *Malacosoma parallela* per 10,000 plants calculated by Table A.3

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,950					9,970		9,983		9,991					10,000
EKE results	9,950	9,953	9,956	9,961	9,966	9,971	9,975	9,982	9,989	9,991	9,994	9,997	9,998	9,999.1	9,999.6

The EKE results are the fitted values.



(a)



(b)

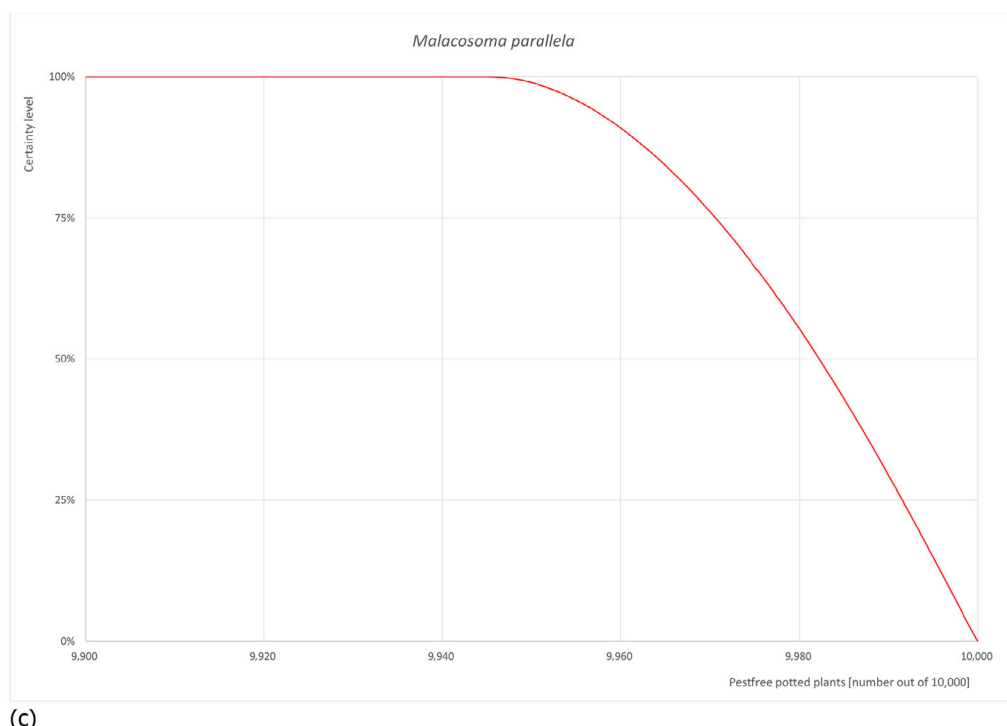


Figure A.2: (a) Elicited uncertainty of pest infestation per 10,000 bundles (histogram in blue—vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free bundles per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 plants

A.2.5. Reference list

- CABI (Centre for Agriculture and Bioscience International), online. Datasheet *Malacosoma parallela* (mountain ring silk moth). Available online: <https://www.cabi.org/isc/datasheet/32330> [Accessed: 27 April 2022].
- EFSA PLH Panel (EFSA Panel on Plant Health), Bragard C, Baptista P, Chatzivassiliou E, Gonthier P, Jaques Miret JA and Yuen J, 2022. Commodity risk assessment of *Malus domestica* plants from Turkey. EFSA Journal 2022;20(5):7301, 35 pp. <https://doi.org/10.2903/j.efsa.2022.7301>
- EPPO (European and Mediterranean Plant Protection Organization), 2005. Data sheets on quarantine pests, *Malacosoma parallela*. OEPP/EPPO, Bulletin OEPP/EPPO Bulletin, 35, 431–433.
- EPPO (European and Mediterranean Plant Protection Organization), online_b. *Malacosoma parallela* (MALAPA). Available online: <https://gd.eppo.int/taxon/MALAPA> [Accessed: 27 April 2022].
- EUROPHYT, online. European Union Notification System for Plant Health Interceptions - EUROPHYT. Available online: https://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/index_en.htm [Accessed: April 2022].
- Degtyareva VI, 1964. The Main Lepidopteran Pests of Trees and Shrubs of the Central Part of Gissar Mountain Ridge and Gissar valley. Izdatel'stvo Akademii Nauk Tadzhikskoi SSR, Dushanbe (TJ) (in Russian).
- Grechkin VP, 1956. Important species of pests of mountain forests of Tajikistan. Zoologicheskii Zhurnal, 35, 1,476–1,492 (in Russian).
- Maslov AD, 1988. Guide to Forest Protection against Pests and Diseases. Agropromizdat, Moscow (RU) (in Russian).
- Pavlovskii EN and Shtakelberg AA, 1955. Guide to Forest Pests. Izdatel'stvo Akademii Nauk SSSR, Moscow–Leningrad (RU) (in Russian).
- Romanenko KE, 1981. Pests of Field Shelter Belts in Kirgizia. Ilim, Frunze (KG) (in Russian).
- Sarkissyan RA, 1972. Population Dynamics of *Euproctis chrysorrhoea* and *Malacosoma parallela* in the Zangezur Mountains of the Armenian SSR.
- TRACES-NT, online. TRAdE Control and Expert System. Available online: <https://webgate.ec.europa.eu/tracesnt> [Accessed: April 2022].

Appendix B – Web of Science All Databases Search String

In the table below, the search string used in Web of Science is reported. In total, 242 papers were retrieved. Titles and abstracts were screened, and 26 pests were added to the list of pests (see Appendix D).

Web of Science All databases	TOPIC: ("Berberis" OR "barberry") AND TOPIC: ("pathogen*" OR pathogenic bacteria OR fung* OR oomycet* OR myce* OR bacteri* OR virus* OR viroid* OR insect\$ OR mite\$ OR phytoplasm* OR arthropod* OR nematod* OR disease\$ OR infecti* OR damag* OR symptom* OR pest\$ OR vector OR hostplant\$ OR "host plant\$" OR host OR "root lesion\$" OR decline\$ OR infestation\$ OR damage\$ OR symptom\$ OR dieback* OR "die back*" OR malaise OR aphid\$ OR curculio OR thrip\$ OR cicad\$ OR miner\$ OR borer\$ OR weevil\$ OR "plant bug\$" OR spittlebug\$ OR moth\$ OR mealybug\$ OR cutworm\$ OR pillbug\$ OR "root feeder\$" OR caterpillar\$ OR "foliar feeder\$" OR virosis OR viruses OR blight\$ OR wilt\$ OR wilted OR canker OR scab\$ OR rot OR rots OR "rotten" OR "damping off" OR "damping-off" OR blister\$ OR smut OR "mould" OR "mould" OR "damping syndrome\$" OR mildew OR scald\$ OR "root knot" OR "root-knot" OR rootkit OR cyst\$ OR "dagger" OR "plant parasitic" OR "parasitic plant" OR "plant\$parasitic" OR "root feeding" OR "root\$feeding" OR "Acari" OR "host\$" OR "gall" OR "gall\$" OR "whitefly" OR "whitefl*" OR "aleyrodidae" OR "Thysanoptera" OR "Moths" OR "scale" OR "scale\$" OR "Thripidae" OR "leafhoppers" OR "leafhopper\$" OR "plant pathogens" OR "Fungal" OR "Aphididae") NOT TOPIC: ("heavy metal\$" OR "pollut*" OR "weather" OR "propert*" OR probes OR "spectr*" OR "antioxidant\$" OR "transformation" OR "Secondary plant metabolite\$" OR metabolite\$ OR Postharvest OR Pollin* OR Ethylene OR Thinning OR fertil* OR Mulching OR Nutrient\$ OR "human virus" OR "animal disease\$" OR "plant extracts" OR "immunological" OR "purified fraction" OR "traditional medicine" OR "medicine" OR mammal\$ OR bird\$ OR "human diseases" OR "cancer" OR "therapeutic" OR "psoriasis" OR "blood" OR "medicinal ethnobotany" OR "Nitrogen-fixing" OR "patients" OR "Probiotic drugs" OR "Antioxidant" OR "Anti-Inflammatory" OR "plasma levels" OR "ethnomedicinal" OR "traditional uses of medicinal plants" OR "Antitumor" OR "Neuroprotective" OR "Hypoglycemic") NOT TOPIC: ("Abortiporus biennis" OR "Bryobia rubrioculus" OR "Eotetranychus carpini" OR "Paraplonobia berberis" OR "Sonotetranychus albiflorae" OR "Tetranychus turkestani" OR "Tetranychus urticae" OR "Thyatira batis" OR "Timora beatrix" OR "Diacrisia unifascia" OR "Chionaema bellissima" OR "Agylla albifinis" OR "Agylla metaxantha" OR "Agylla ramelana" OR "Berberisomyia sobolevi" OR "Jaapiella kovalevi" OR "Amegospion platycadum" OR "Aphis nasturtii" OR "Aphis odinae" OR "Aphis spiraeola" OR "Aulacorthum solani" OR "Berberidaphis lydiae" OR "Liosomaphis atra" OR "Liosomaphis berberidis" OR "Liosomaphis ornata" OR "Myzus persicae" OR "Toxoptera aurantii" OR "Toxoptera citricida" OR "Metopolophium berberinutritum" OR "Wahlgreniella nervata" OR "Greenidea kumaoni" OR "Macrosiphum pachysiphon" OR "Prociphilus erigeronensis" OR "Rhopalosiphum rufiabdominalis" OR "Xenosiphonaphis conandri" OR "Hydaphis hofmanni" OR "Tricaudatus polygoni" OR "Macrosiphum euphorbiae" OR "Aphis berberidorum" OR "Aphis patagonica" OR "Liosomaphis himalayensis" OR "Arge ochropus" OR "Bemisia tabaci" OR "Caliroa annulipes" OR "Coccus hesperidum" OR "Diaspidiotus perniciosus" OR "Lobesia botrana" OR "Aporia crataegi" OR "Callirhopalus bifasciatus" OR "Omphalocera dentosa" OR "Coryphista meadii" OR "Alcis repandata" OR "Argyresthia bonnetella" OR "Calliteara pudibunda" OR "Dasineura berberidis" OR "Eupithecia exigua" OR "Eupithecia subfasciata" OR "Euproctis similis" OR "Gonocerus acutangulatus" OR "Hemithea aestivaria" OR "Lacanobia thalassina" OR "Melanchra persicariae" OR "Odontopera bidentata" OR
------------------------------	--

"Pareulype berberata" OR *"Phlogophora meticolosa"* OR *"Rhagoletis cerasi"* OR *"Rhagoletis meigenii"* OR *"Rheumaptera cervinalis"* OR *"Spilosoma luteum"* OR *"Strymonidia pruni"* OR *"Agrochola helvola"* OR *"Alypia octomaculata"* OR *"Athyma opalina"* OR *"Attacus taprobanis"* OR *"Auchmis detera"* OR *"Auchmis inextricata"* OR *"Biston regalis"* OR *"Cadra cautella"* OR *"Calliteara grotei"* OR *"Callosamia promethea"* OR *"Carposina berberidella"* OR *"Cheimophila salicella"* OR *"Gastropacha quercifolia"* OR *"Hyalophora cecropia"* OR *"Hyperchiria incisa"* OR *"Hyphantria cunea"* OR *"Larerrannis orthogrammaria"* OR *"Lycia hirtaria"* OR *"Lymantria dispar"* OR *"Neostauropus sikkimensis"* OR *"Omphalocera cariosa"* OR *"Parocystola acroxantha"* OR *"Phtheochroa decipiens"* OR *"Plodia interpunctella"* OR *"Pseudoglaea olivata"* OR *"Rheumaptera undulata"* OR *"Rhopobota myrtillana"* OR *"Samia cynthia"* OR *"Samia walkeri"* OR *"Somena scintillans"* OR *"Trabala vishnou"* OR *"Triphosa haesitata"* OR *"Orgyia leucostigma"* OR *"Lindingaspis rossi"* OR *"Cacoecimorpha pronubana"* OR *"Drosophila suzukii"* OR *"Malacosoma americanum"* OR *"Malacosoma parallela"* OR *"Ceratitis capitata"* OR *"Ceroplastes ceriferus"* OR *"Thyridopteryx ephemeraeformis"* OR *"Aleuroplatus berbericolus"* OR *"Aleuroplatus ovatus"* OR *"Bemisia berbericola"* OR *"Bemisia shinanoensis"* OR *"Aceria caliberberis"* OR *"Acleris variegana"* OR *"Anomoia purmunda"* OR *"Arge berberidis"* OR *"Conistra ligula"* OR *"Ditula angustiorana"* OR *"Diurnea lipsiella"* OR *"Exapate congelatella"* OR *"Gymnoscelis rufifasciata"* OR *"Lasioptera berberina"* OR *"Orientus ishidae"* OR *"Ourapteryx sambucaria"* OR *"Phyllocoptes granulatus"* OR *"Pseudotelphusa tessella"* OR *"Pulvinaria floccifera"* OR *"Rhagoletis berberidis"* OR *"Peribatodes rhomboidaria"* OR *"Hypomecis punctinalis"* OR *"Ectropis crepuscularia"* OR *"Lasiocampa quercus"* OR *"Crocallis tusciaria"* OR *"Doloploca punctulana"* OR *"Ligdia adustata"* OR *"Lycia graecarius"* OR *"Zeuzera pyrina"* OR *"Athetis lepigone"* OR *"Ceroplastes sinensis"* OR *"Aphis fabae"* OR *"Agonoscena pegani"* OR *"Bactericera berberae"* OR *"Cacopsylla curtiantenna"* OR *"Cyamophila fabra"* OR *"Cyamophila otidaexocha"* OR *"Euphyllura berberae"* OR *"Trioza berbericola"* OR *"Trioza berberidis"* OR *"Trioza fissa"* OR *"Trioza inlechsii"* OR *"Trioza lischines"* OR *"Trioza longipennis"* OR *"Trioza nilisches"* OR *"Trioza scottii"* OR *"Trioza striacauda"* OR *"Trioza subberbericola"* OR *"Aonidiella aurantii"* OR *"Aonidiella citrina"* OR *"Arctothezia pseudoccidentalis"* OR *"Aspidaspis densiflorae"* OR *"Aspidiotus nerii"* OR *"Cercococcus koebeleii"* OR *"Cercococcus parrotii"* OR *"Ceroplastes japonicus"* OR *"Ceroplastes pseudoceriferus"* OR *"Chrysomphalus aonidum"* OR *"Chrysomphalus dictyospermi"* OR *"Coccurea suwakoensis"* OR *"Coccus pseudomagnoliarum"* OR *"Diaspidiotus africanus"* OR *"Diaspidiotus uvae"* OR *"Dynaspidiotus britannicus"* OR *"Epidiaspis leperii"* OR *"Erimococcus kimmericus"* OR *"Heliococcus sulcii"* OR *"Hemiberlesia lataniae"* OR *"Icerya purchasi"* OR *"Lecanodiaspis prosopidis"* OR *"Lecanodiaspis thamnospae"* OR *"Lepidosaphes malicola"* OR *"Lepidosaphes ulmi"* OR *"Magnococcus berberis"* OR *"Neoselenaspis silvaticus"* OR *"Paracoccus burnerae"* OR *"Parlatoreopsis longispina"* OR *"Parlatoria camelliae"* OR *"Parlatoria oleae"* OR *"Parlatoria pergandii"* OR *"Parthenolecanium persicae"* OR *"Peliococcus morrisoni"* OR *"Phenacoccus aceris"* OR *"Phenacoccus berberis"* OR *"Phenacoccus tataricus"* OR *"Pseudaulacaspis cockerelli"* OR *"Pseudaulacaspis pentagona"* OR *"Pseudococcus comstocki"* OR *"Spiroporococcus braggi"* OR *"Pseudococcus maritimus"* OR *"Puccinia arrhenatheri"* OR *"Didymosphaeria oblitescens"* OR *"Gnomonia comari"* OR *"Leptosphaeria fuscella"* OR *"Monilinia fructigena"* OR *"Roselinia necatrix"* OR *"Verticillium albo-atrum"* OR *"Verticillium dahliae"* OR *"Alternaria alternata"* OR *"Erysiphe berberidicola"* OR *"Puccinia graminis f. sp. Tritici"* OR *"Puccinia striiformoides"* OR *"Sclerotinia sclerotiorum"* OR *"Thyronectria berberidis"* OR *"Erysiphe communis"* OR *"Eutypa lata"* OR *"Rebentischia unicaudata"* OR *"Rhizoctonia solani"* OR *"Sclerotium rolfsii"* OR *"Pleospora herbarum"* OR *"Puccinia graminis f. oryzae"* OR *"Puccinia graminis"* OR *"Puccinia striiformis"* OR *"Phoma glomerata"* OR *"Phyllactinia guttata"* OR *"Septoria berberidis"* OR *"Phytophthora nicotianae var. Parasitica"* OR *"Polychaeton quercinum"* OR *"Hymenochaete colliculosa"* OR *"Heterobasidion annosum"* OR *"Phytophthora cinnamomi"* OR *"Phytophthora ramorum"* OR *"Phymatotrichum omnivorum"* OR *"Puccinia graminis"* OR *"Phytophthora kernoviae"* OR *"Didymella nigricans"* OR *"Lyomyces sambuci"* OR *"Neofusicoccum luteum"* OR *"Anguilospora longissima"* OR *"Anguilospora crassa"* OR *"Bacillispora aquatica"* OR *"Campylospora parvula"* OR *"Epicoccum nigrum"* OR *"Thyronectria lamyi"* OR *"Heliscus lugdunensis"* OR *"Diplodina berberidina"* OR *"Amphisphaeria berberidicola"* OR *"Amphisphaeria dusenii"* OR *"Apiosporium salicinum"* OR *"Ascochyta australis"* OR *"Ascochyta berberidina"* OR *"Asteromassaria berberidicola"* OR *"Belonium subantarcticum"* OR *"Blennoria patagonica"* OR *"Botryosphaeria dothidea"* OR

Botryosphaeria ribis OR *Calospora etilis* OR *Camarosporium antarcticum* OR *Camarosporium berberidicola* OR *Camarosporium berberidis* OR *Capnodium berberidis* OR *Cercospora boutelouae* OR *Ceuthospora foliicola* OR *Ceuthospora magellanica* OR *Chaetomium setosum* OR *Ciboria ranikhetiensis* OR *Cladosporium aecidiicola* OR *Cladosporium fumago* OR *Cladosporium quitense* OR *Cladosporium ushuwaiense* OR *Coccomyces coronatus* OR *Colletotrichum aotearoa* OR *Coniochaeta ligniaria* OR *Coniochaeta niesslii* OR *Coniochaeta sanguinolenta* OR *Coniothyrium berberidiphilum* OR *Coniothyrium berberidis* OR *Coniothyrium bergii* OR *Coniothyrium insitivum* OR *Coronophora paucispora* OR *Corticium calceum* OR *Corticium incarnatum* var. *Antarcticum* OR *Corticium solani* OR *Coryneum foliicola* OR *Crumenula antarctica* OR *Cucurbitaria oromediterranea* OR *Cumminsiella antarctica* OR *Cumminsiella mirabilissima* OR *Cumminsiella santa* OR *Cumminsiella standleyana* OR *Cumminsiella stolpiana* OR *Cumminsiella wootoniana* OR *Desmella quitensis* OR *Diaporthe detrusa* OR *Diatrype berberidis* OR *Dicaeoma poculiforme* OR *Dichomera macrospora* OR *Didymella aliena* OR *Didymella cadubriae* OR *Didymosphaeria berberidicola* OR *Didymosphaeria epidermidis* OR *Diplodia berberidis* OR *Diplodia mahoniae* OR *Diplodia microsporella* OR *Dothidea berberidis* OR *Dothidea hippophaes* OR *Dothidea indica* OR *Dothiorella ribis* OR *Edythea berberidis* OR *Edythea quitensis* OR *Edythea soratensis* OR *Edythea tenella* OR *Eichleriella leucophaea* OR *Epitea berberidis* OR *Eriosphaeria australis* OR *Erysiphe berberidis* OR *Erysiphe dimorpha* OR *Erysiphe golovinii* OR *Erysiphe multappendicis* OR *Erysiphe polygoni* OR *Erysiphe sichuanica* OR *Erysiphe thaxteri* OR *Eutypa peraffinis* OR *Eutypella aequilinearis* OR *Eutypella russodes* OR *Excipularia fusispora* OR *Fenestella rostrata* OR *Fumago pannosa* OR *Fumago vagans* OR *Gambleola cornuta* OR *Gibbera patagonica* OR *Guignardia cytisi* OR *Haematomyxa pakistani* OR *Helminthosporium velutinum* OR *Helotium buccinula* OR *Helotium caudatum* OR *Helotium titubans* OR *Hendersonia dickasonii* OR *Hendersonia sarmentorum* OR *Heterosporium berberidis* OR *Hirneola antarctica* OR *Hoehneliella perplexa* OR *Hymenoscyphus buccinula* OR *Hymenoscyphus leucopus* OR *Hyphoderma praetermissum* OR *Hypoderma brachysporum* OR *Junghuhnina vineta* OR *Karschia fuegiana* OR *Keissleriella cladophila* OR *Lachnum albidulum* OR *Laestadia angulata* OR *Lambertella berberidis* OR *Lambertella kumaonica* OR *Laschia antarctica* OR *Leptosphaeria artemisiae* OR *Leptosphaeria berberidicola* OR *Leptosphaeria berberidis* OR *Leptosphaeria castagnei* OR *Leptosphaeria coniothyrium* OR *Leptosphaeria inconspicua* OR *Leptosphaeria punjabensis* OR *Leptothyrium berberidis* OR *Lophiostoma macrostomoides* OR *Lophiostoma quadrinucleatum* OR *Lophodermium berberidis* OR *Lophodermium hysterioides* OR *Marasmius copelandii* OR *Marasmius salalis* OR *Marasmius sphaerodermus* OR *Massaria berberidicola* OR *Massaria marginata* OR *Massarina polymorpha* OR *Melanomma pulvis-pyrius* OR *Melanomma pulviscula* OR *Melasma berberidis* OR *Metasphaeria desolationis* OR *Microdiplodia microsporella* OR *Microthyrium fagi* OR *Moellerodiscus berberidis* OR *Monochaetia berberidicola* OR *Monochaetia berberidis* OR *Montagnella berberidis* OR *Mycoporum hippocastani* OR *Mycosphaerella ambiens* OR *Mycosphaerella berberidis* OR *Nectria antarctica* OR *Nectria berberidicola* OR *Nectria lamyi* OR *Odontia arguta* OR *Oncopodium antoniae* OR *Otthia amelanchieris* OR *Otthia lisae* OR *Pestalotia berberidis* OR *Pestalotia jodhpurensis* OR *Pestalotia osyridis* OR *Pestalotiopsis japonica* OR *Pestalozzina berberidina* OR *Pestalozzina berberidis* OR *Phaeodothis winteri* OR *Phoma berberidella* OR *Phoma berberina* OR *Phoma empetrifolia* OR *Phoma herbarum* OR *Phomopsis berberidis* OR *Phyllactinia berberidis* OR *Phyllosticta berberidicola* OR *Phyllosticta berberidis* OR *Phyllosticta garbovskii* OR *Phyllosticta japonica* OR *Phyllosticta mahoniicola* OR *Phyllosticta westendorpii* OR *Phytophthora plurivora* OR *Platysporoides togwotiensis* OR *Pleosphaeria fuegiana* OR *Pleospora aggregata* OR *Pleospora amelanchieris* OR *Pleospora berberidicola* OR *Pleospora berberidis* OR *Pleospora coronata* OR *Pleospora orbicularis* OR *Pleospora quadrisepata* OR *Pleospora rudis* OR *Pleospora togwotiensis* OR *Polyporus lepideus* OR *Polyporus vaporarius* OR *Poria punctata* OR *Pseudocercospora berberidis-vulgaris* OR *Pseudocercospora nandinae* OR *Puccinella graminis* OR *Puccinia antarctica* OR *Puccinia barri-aranae* OR *Puccinia berberidis* OR *Puccinia berberidis-darwinii* OR *Puccinia culmicola* OR *Puccinia droogenis* OR *Puccinia fendleri* OR *Puccinia magelhaenica* OR *Puccinia magellanica* OR *Puccinia meyeri-alberti* OR *Puccinia montanensis* OR *Puccinia naumanniana* OR *Puccinia*

poculiformis" OR "*Puccinia rameliana*" OR "*Puccinia ramelianoides*" OR "*Puccinia stolpiana*" OR "*Puccinia wurthii*" OR "*Pucciniastrum goeppertianum*" OR "*Puccinosira clemensiae*" OR "*Puccinosira cornuta*" OR "*Pythium debaryanum*" OR "*Ramaria subaurantiaca*" OR "*Ramularia berberidis*" OR "*Rebentischia pomiformis*" OR "*Rhabdospora berberidis*" OR "*Rosellinia sanguinolenta*" OR "*Rosellinia subsimilis*" OR "*Saccardoella berberidis*" OR "*Saccardoella transylvanica*" OR "*Sarcostroma berberidis*" OR "*Sclerotium dothideoides*" OR "*Scytinostroma duriusculum*" OR "*Seimatosporium berberidicola*" OR "*Sphaeropsis berberidis*" OR "*Sporoschisma saccardoii*" OR "*Stagonospora berberidina*" OR "*Stenella quitensis*" OR "*Stictis polycocca*" OR "*Stylodothis indica*" OR "*Tassia laurina*" OR "*Thyridium vestitum*" OR "*Thyronectria caudata*" OR "*Togninia minima*" OR "*Trametes versicolor*" OR "*Tryblidaria esfandiarii*" OR "*Tryblidaria pakistani*" OR "*Uredo berberidis*" OR "*Uredo clemensiae*" OR "*Uredo stolpiana*" OR "*Uropyxis naumanniana*" OR "*Uropyxis quitensis*" OR "*Valsaria insitiva*" OR "*Zignoella longispora*" OR "*Phoma macrostoma*" OR "*Aureobasidium pullulans*" OR "*Phoma andina*" OR "*Cyrtidula hippocastani*" OR "*Dasyscyphus australis* var. *Lasiopoda*" OR "*Dasyscyphus minutissimus*" OR "*Diaporthe koelreuteriae*" OR "*Nectria episphaeria*" OR "*Nodulosphaeria robusta*" OR "*Phyllosticta mahoniae*" OR "*Nectria cinnabarina*" OR "*Cumminsia texana*" OR "*Curreya berberidis*" OR "*Cytospora berberidis*" OR "*Cucurbitaria berberidis*" OR "*Parodiella negeriana*" OR "*Plowrightia berberidis*" OR "*Puccinia brachypodii*" OR "*Botrytis cinerea*" OR "*Erysiphe berberidis* var. *Asiatica*" OR "*Microsphaera grossulariae*" OR "*Myrothecium inundatum*" OR "*Pezicula microspora*" OR "*Microsphaera alni*" OR "*Acarosporina berberidis*" OR "*Aecidium aridum*" OR "*Aecidium berberidis-morrisonensis*" OR "*Aecidium berberidis-ruscifoliae*" OR "*Aecidium jacobsthalii-henrici*" OR "*Aecidium leveilleum*" OR "*Aecidium montanum*" OR "*Aecidium navarinum*" OR "*Aecidium nitakense*" OR "*Aecidium subflammans*" OR "*Aecidium teodorescui*" OR "*Aecidium tubiforme*" OR "*Agaricus aulaxinus*" OR "*Agaricus berberidicola*" OR "*Agaricus subflammans*" OR "*Agyrium subantarcticum*" OR "*Aecidium haussknechtianum*" OR "*Puccinia pseudostriiformis*" OR "*Puccinia pygmaea*" OR "*Coccomyces dentatus*" OR "*Microsphaeropsis conielloides*" OR "*Phyllosticta capitalensis*" OR "*Puccinia minshanensis*" OR "*Puccinia brachypodii-phoenicoidis*" OR "*Meloidogyne javanica*" OR "*Meloidogyne hapla*" OR "*Meloidogyne arenaria*" OR "*Xiphinema brevicolle*" OR "*Pratylenchus penetrans*" OR "*Merlinius brevidens*" OR "*Pratylenchus vulnus*" OR "*Boleodorus typicus*" OR "*Rotylenchus buxophilus*" OR "*Boleodorus impar*" OR "*Boleodorus volutus*" OR "*Boleodorus thylactus*" OR "*Tylenchus bhitai*" OR "*Xiphinema globosum*" OR "*Meloidogyne incognita*" OR "*Apple mosaic virus*" OR "*Cucumber mosaic virus*" OR "*Impatiens necrotic spot virus*" OR "*Tomato spotted wilt virus*" OR "*Pseudomonas syringae* pv. *berberidis*" OR "*Phytoplasma* - 16SrV-B subgroup" OR "*Phytoplasma* - 16SrII-C subgroup" OR "*Phytoplasma* - 16SrXIII-F subgroup" OR "*Geocrenatus dobroticus*" OR "*Paratylenchus vandenbrandei*" OR "*Criconemoides morgensis*" OR "*Iratylenchus vicinus*" OR "*Neopsilenchus magnidens*" OR "*Trophurus impar*" OR "*Pratylenchoides alkani*" OR "*Merlinius brevidens*" OR "*Scutylenchus tartuensis*" OR "*Puccinia meyeri-albertii*" OR "*Pseudargyrotoza conwagana*" OR "*Rhagastis mongoliana mongoliana*" OR "*Sphenoraia berberii*" OR "*Sphenoraia yajiangensis*" OR "*Stenoluperus nipponensis*" OR "*Xyleborus brevis*" OR "*Zeugophora cyanea*" OR "*Rhagastis mongoliana centrosinaria*" OR "*Rhagastis mongoliana pallicosta*" OR "*Orhespera glabricollis*" OR "*Orhespera impressicollis*" OR "*Pandemis ribeana*" OR "*Phenacoccus prodigialis*" OR "*Euscotia inextricata*" OR "*Elastomethus brevis*" OR "*Aphthona varipes*" OR "*Aporia agathon*" OR "*Aporia hippia*" OR "*Aporia leucodice*" OR "*Attacus atlas*" OR "*Cacia cretifera*" OR "*Colletotrichum acutatum*" OR "*Colletotrichum gloeosporioides*" OR "*Gloeosporium berberidis*" OR "*Alternaria macrospora*" OR "*Alternaria solani*" OR "*Aspergillus flavus*" OR "*Cercospora citrullina*" OR "*Clonostachys rosea*" OR "*Colletotrichum coccodes*" OR "*Colletotrichum coffeanum*" OR "*Colletotrichum kahawae*" OR "*Diaporthe tersa*" OR "*Fusarium lateritium*" OR "*Fusarium falciforme*" OR "*Fusarium nematophilum*" OR "*Fusarium oxysporum*" OR "*Fusarium solani*" OR "*Haplothrips andresi*" OR "*Haplothrips angusticornis*" OR "*Acaudaleyrodes rachipora*" OR "*Metcalfe pruinosae*" OR "*Taeniothrips inconsequens*" OR "*Corthylus punctatissimus*" OR "*Malacosoma neustria*" OR "*Aphis pomi*" OR "*Rhopalosiphum rufiabdominale*" OR "*Contarinia nasturtii*" OR "*Dendrothrips saltatrix*" OR "*Haplothrips reuteri*" OR "*Mycterothrips albicornis*" OR "*Thrips meridionalis*" OR "*Thrips tabaci*" OR "*Thrips trehernei*" OR "*Metcalfe pruinosa*")

Appendix C – List of pests that can potentially cause an effect not further assessed

Table C.1: List of potential pests not further assessed

Pest name	EPPO code	Group	Pest present in Turkey	Present in the EU	<i>Berberis</i> confirmed as a host (reference)	Pest can be associated with the commodity	Impact	Justification for inclusion in this list
<i>Erysiphe berberidicola</i>	–	Fungi	Yes	No	Yes	Yes	Uncertain	No records of official control in EU. Genus of <i>Erysiphe</i> contains fungi with impact, but and there is no information available on potential impact for <i>Erysiphe berberidicola</i> .
<i>Lepidosaphes malicola</i>	LEPSML	Insects	Yes	Limited (Greece, Bulgaria)	Yes	Yes	Uncertain	No records of official control in EU; limited information on damage; apple damage reported in Israel.

Appendix D – Excel file with the pest list of *Berberis* spp.

Appendix D can be found in the online version of this output (in the 'Supporting information' section): <https://doi.org/10.2903/j.efsa.2022.7392>.